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# 'Plant hunting for commercial horticulture and access and benefit sharing: complementary or competitive uses of wild novel plants?'

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## Abstract

In this thesis the relationship between the acquisition of novel plants from the wild for use in ornamental horticulture, commonly referred to as Plant Hunting, and access and benefit sharing introduced under the Nagoya Protocol (2010), part of the United Nations Convention on Biological Diversity (CBD), is investigated. The Nagoya Protocol allows for countries to set out terms under which access may be given to their indigenous genetic resources in return for benefits from any research and development of those genetic resources. Many countries also put their own restrictions on the commercialisation of wild plants and seed. The key question that this thesis sets out to address is as follows: **‘Plant hunting for commercial horticulture and access and benefit sharing: complementary or competitive uses of wild novel plants?’** To address this question, we first undertook a literature review that revealed that there is little peer reviewed research available to address our research question. This knowledge gap is then examined in three chapters. First, we present an exploratory analysis of data from the Royal Horticultural Society’s Plant Finder to understand the relevance of Known Wild Provenance (KWP) plants to commercial horticulture and investigate whether the availability of such plants in commercial horticulture could provide any non-monetary benefits. Second, an analysis of the potential for monetary benefits to provider-countries in return for KWP plant material is undertaken using consumer preference data gathered as part of a choice experiment. Key findings show that commercial horticulture does not currently contribute to global plant conservation targets despite there being both the available plants and the potential for additional profit from the sale of such plants with which to do so. Ex-situ conservation within the country in which the plant is being sold could be offered by commercial ornamental horticulture as a non-monetary benefit in return for legal access to wild plant genetic resources. Additionally, KWP did not prove to be a strong driver for plant buyers, although there is positive value attached to the attribute by a significant segment of the buying population. Thus, the ability for commercial horticulture to provide monetary benefits is shown, however, Access and Benefit Sharing (ABS) negotiations should not be based solely on monetary benefits from the sale of plants. Third, in the

form of a case study, the practical application of the research is considered with relevance to the sale of a threatened plant species, *Magnolia stellata*, that is widely available within commercial horticulture. Using findings from Chapters 1, 2 and 3 we explore how access to wild material of *M. stellata*, and its subsequent commercialisation could lead to both monetary and non-monetary benefits being returned to the provider country, in this case Japan, for use towards the species' conservation.

Whilst this thesis reveals the continued relevance of the plant hunter for commercial horticulture is clear, more research is certainly required to understand how this can be compatible with ABS regulations. A step change in approach from both sides of ABS agreements is likely needed in order to enable both access and, in return, benefits from the sale of ornamental plants with KWP.

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## List of abbreviations

Access and Benefit Sharing (ABS)

Access without benefit sharing (AWBS).

Alpine Garden Society (AGS)

Botanic Gardens Conservation International (BGCI)

Choice experiment (CE)

Confidence interval (CI)

Extent of occurrence (EOO)

Food and Agriculture Organisation of the United Nations (FAO)

Global Strategy for Plant Conservation (GSPC)

inferred global threat status (GTS)

International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA)

Known Wild Provenance (KWP)

Latent Class Model (LCM)

multinomial logit regression model (MNL)

National Biodiversity Institute (NBI)

Plant variety rights or Plant breeders' rights (PVR)

Royal Horticultural Society (RHS)

Scottish Rock Garden Club (SRGC)

South African National Biodiversity Institute (SANBI)

Species (spp.)

Standard Error (SE)

The Convention on the International Trade in Endangered Species (CITES).

United Nations Convention on Biological Diversity (CBD)

Western Cape Nature Conservation board, now CapeNature (WCNCA)

Willingness to Accept (WTA)

Willingness to Pay (WTP)

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## Ethics

Ethics approval was granted by the Research and Ethics Committee of the School of Anthropology and Conservation, University of Kent. This involved a two-stage process as a number of plant societies were required to act as gate keepers, distributing surveys to their members.

## Introduction

Plant hunting, the process of collecting novel plant material for the purposes of scientific understanding and cultivation, has been at the heart of horticulture for as long as horticulture has existed with the earliest recorded example of plant hunting from around 1500BC (Janick 2007). During the 18<sup>th</sup> and 19<sup>th</sup> centuries plant hunting reached a peak, with the Victorians' heightened appetite for new and interesting plants from around the world. Plant hunting played a vital part in the discovery of commodities such as tea and rubber which were of great importance to the British economy, and thus the British Empire. However, the majority of plants introduced by plant hunters were for gardens; both for science and pleasure (Fry 2009). Today this tradition continues, albeit on a smaller scale, with nurseries offering plants raised from seed or propagation material collected in the wild that has its point of wild origin documented and linked to it at the point of sale by a collector's code or reference number (Known Wild Provenance). The demand from gardeners for these plants continues and many ornamental plant nurseries rely on known wild provenance (KWP) material either partially or, in some cases, almost entirely for the unique position afforded by it in the ornamentals market (e.g. Crûg Farm 2018).

In 1993, the Convention on Biological Diversity (CBD) came into effect. While many countries already had a permit system in place to allow for collection of seed, this now put national jurisdiction over genetic resources into international law. It has allowed each country's individual legislation to link to, and be guided by, an international framework. The Nagoya Protocol allows for countries to set out terms under which access may be given to their genetic resources in return for benefits from any research and development of those genetic resources anywhere in the world. Many countries also put restrictions on the commercialisation of the seed collected and subsequently the plants propagated from it. Many of these plants are made available for sale upon the point at which they

are of a suitable size to do so with little research and development such as testing for hardiness or cultivar selection (Crûg Farm Plants 2016, Pan Global Plants URL. <http://www.panglobalplants.com/>).

This thesis is formed of a series of chapters considering individual aspects related to the interaction between the international legislation and those who access wild plant material for commercial horticulture. It aims to go some way towards answering the key research question **‘Plant hunting for commercial horticulture and access and benefit sharing: complementary or competitive uses of wild novel plants?’**

### Thesis outline

The thesis investigates, through a literature review, commercially available species analysis and a choice experiment, the extent to which wild provenance plants and, subsequently, the tradition of the plant hunter is still relevant to commercial ornamental horticulture in the UK. It also aims to determine the extent to which commercial horticulture is relevant to conservation practice and how it may be married with international and national legislation regarding access and benefit sharing.

**Chapter 1:** A literature review, aims to understand if there is previously published literature, both in the grey and peer reviewed literature, with the objective of answering the research question it also aims to identifying the gaps in knowledge regarding the interaction between plant hunting for commercial horticulture and access and benefit sharing legislation. This review looks at the literature with regard to the practical application of the ABS for horticulture rather than trying to encompass the extensive legal literature. It finds that the available literature could be categorised into subsections that pose a range of supplementary, yet integral, questions that lead to the following chapters.

**Chapter 2:** The first of two data analytics chapters aiming to answer the supplementary questions from chapter 1. This chapter uses data from the Royal Horticultural Society's Plant Finder to ascertain the prevalence in commercial horticulture of wild provenance plants. It goes on to use the RHS Plant Finder data to understand whether there is potential for ornamental commercial horticulture to provide the non-monetary benefit of plant conservation through the introduction and sale of such wild plants.

**Chapter 3:** Goes on with the aim of understanding whether there is consumer preference for known wild provenance plants in the horticultural trade and whether any preference leads to increase in the amount of money customers may be prepared to pay for such plants. The objective of this chapter is to understand if there is a monetary benefit available from the sale of plants with known wild provenance that could be offered to provider countries in return for access to such wild plant material.

**Chapter 4:** The three main chapters (the literature review and two data analytics chapters) culminate in a case study that brings the evidence of all three together in a hypothetical and practical application that aims to show how plant hunting and ABS could be either complementary or competitive.

Through these four chapters, evidence is provided with regard to either the complementary or competitive relationship between commercial horticulture and the Nagoya Protocol thus addressing the question 'Plant hunting for commercial horticulture and access and benefit sharing: complementary or competitive uses of wild novel plants?'

## Chapter 1: Literature review

### 1.1 Introduction to Access and Benefit Sharing

In 1993, the CBD came into effect (CBD 2016a). While many countries already had a permit system in place to allow for the collection and commercialisation of seed, this put national jurisdiction over genetic resources into international law. It has given each country's individual legislation an international framework on which to hang. The Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the CBD, also known as the 'Nagoya Protocol on Access and Benefit Sharing' (ABS) was adopted at the tenth meeting of the Conference of the Parties on 29<sup>th</sup> October 2010, coming into effect on the 12<sup>th</sup> October 2014, and is a supplementary agreement to the CBD (CBD 2016b). It provides a transparent legal framework for the effective implementation of one of the three objectives of the CBD; the fair and equitable sharing of benefits arising out of the utilization of genetic resources (CBD 2016b). By helping to ensure benefit-sharing, ABS creates incentives to conserve and sustainably use genetic resources, and therefore enhances the contribution of biodiversity to development and human well-being. ABS allows for countries to set out terms under which access may be given to genetic resources in return for benefits from any research and development. Many countries also put restrictions on the commercialisation of wild collected seed, and the resulting plants that are grown, even though there may be no initial intention to do any research and development (The Royal Horticultural Society 2014).

The idea that access to genetic resources could be granted by a country in return for monetary or non-monetary benefits first evolved from the realisation that biodiversity was a commodity worth protecting. The theory that the rainforests may hold the pharmaceuticals of the future was one used by conservationists as a means of persuading stakeholders to protect some of the most biodiverse regions of the world. Ansari and Laxman's (2013) review of the development of the international

framework for access and benefit sharing states that this idea, led by the Southern hemisphere countries where most of the world's biodiversity lay, started the call for return as "*Considerable profits were generated on a global scale from pharmaceutical, genetic modification and biochemical activities carried out by giant, transnational corporations ('gene giants') located in the north 'without significant return to the source country'*" (Ansari & Laxman 2013 p.107). Ansari and Laxman (2013) go on to say, "*As the patenting of life forms became a possibility from the early 1980s in the United States and Europe, the issue of access and benefit sharing gained momentum in the international law arena.*" (Ansari & Laxman 2013 p.107)

Ansari and Laxman's (2013) analysis, of the inclusion of ABS legislation into the CBD, points to how the discontent of the Global South led to the fall of the idea that biodiversity should be the '*common heritage of mankind*' and how, in short, the CBD's ABS mechanism was all set to even out these 'global inequalities'. They go on to point out that the intention of the ABS mechanism was to halt or even reverse the loss of biodiversity internationally by realising its economic importance (Ansari & Laxman 2013). It was hoped that this new form of '*green developmentalism*' and '*commodification of nature*' would go on to pave the way to better legal protections for biodiversity.

Before the CBD came into place, access to plant genetic resources was unrestricted and formalised only by the Food and Agriculture Organisation of the United Nations (FAO) (2018); much had been left to the consideration and legislative will of individual countries. The process of arriving at how the new ABS legislation would form part of the CBD is described as having "*remained contentious until the last minute*" and thus, inducing a bargain to be reached between provider and user countries. The primary obligation of countries rich in biodiversity was to enable access, "*to create conditions to facilitate access to genetic resources for environmentally sound uses*", without undue restrictions (Ansari & Laxman 2013).

Prof. Sir Peter Crane, one of the drivers of the CBD through his tenure as Director of the Royal Botanic Gardens, Kew, explained how this access to genetic resources became so inextricably linked to the benefits that could be gained from allowing that access (Crane 2013). *“Heightened expectations of financial reward concerns about possible biopiracy and a general lack of trust took the convention still farther, to the point of linking the sharing of benefits not just to commercial utilisation of biodiversity but also to access to it”* (Crane 2013 p.267). Crane goes on to discuss the role of the CBD and ABS and the flaws that have come along with them, not least of all its lack of financial return; *“The CBD had produced little revenue for countries that are rich in biodiversity”* (Crane 2013 p.268).

The practice of commercially exploiting naturally occurring biochemical or genetic material, especially by obtaining patents that restrict its future use, while failing to pay fair compensation to the community from which it originates is known as access without benefit sharing (AWBS). An example of AWBS is discussed by Feng (2017). Feng (2017) highlights the case of U.S. chemicals corporation, W.R. Grace’s (Grace), who isolated the chemical azadirachtin, an active ingredient from the Indian neem tree, that has pesticide qualities. Grace applied for, and was awarded, a patent on this refined product without any share of benefits going to the Neem’s country of origin, India (Feng 2017). This AWBS has been seen repeatedly and Feng (2017) provides several other examples in direct relation to plants.

In some cases, there have been instances where AWBS has led to a long-term positive outcome. The case of *Hoodia gordonii* and the San people of South Africa, illustrated by the CBD as part of one of its case studies (Secretariat of the Convention on Biological Diversity 2006), forms a good example. The first research into the benefits of Hoodia started in 1965 with a lengthy period of development culminating in the patented use of the plant as an appetite suppressant in 1995 without any ABS agreement entered with the San (the owners of the intellectual property through traditional

knowledge). However, after a long and protracted legal and ethical debate a memorandum of understanding was finally reached in 2002 (Laird & Wynberg 2008, Secretariat of the Convention on Biological Diversity 2006). As part of this agreement the San would receive 6% of all product royalties resulting of the successful exploitation of Hoodia for the duration of the royalty period and they would also receive eight percent of the milestone income received when certain performance targets were reached during the product development period. These monies were to be paid into a trust and used to raise the standard of living and well-being of the San peoples (Secretariat of the Convention on Biological Diversity 2006).

The Khoi and San peoples of South Africa have been involved in a further two benefit sharing agreements surrounding their traditional knowledge, that of Kanna (*Sceletium tortuosum*); the extract of which is used in Zembrin® a product that reduces anxiety, stress, and depression, and Rooibos (*Aspalanthus linearis*); known across the world as a caffeine free tea but also used in a range of other products for its nutritional and health benefits. In the case of Kanna 5% of all sales of the extract are paid into a trust fund for the San peoples, with a further 1% paid for the use of a San logo on the product. The benefit sharing agreement for Rooibos generates a monetary benefit in the form of an annual levy of 1.5% on the price paid by the products processors for unprocessed rooibos. South Africa produces around 15,000 tons of processed rooibos per year with an income in the region of £25 million (Schroeder 2020).

The cases of the Indian Neem tree, Hoodia, Rooibos and Kanna are uses by global industry giants of genetic resources and traditional knowledge surrounding plants for mass profits. In the cases of Hoodia, Rooibos and Kanna benefit sharing agreements have been reached. Comparatively smaller industries, such as ornamental horticulture, use plant genetic resources and are also taken into consideration in the legislation and treated in the same manner, by the CBD (Laird & Wynberg 2008).



## 1.2 Direct relationship of ABS to Horticulture

The ABS legislation made clear from the outset that all users of genetic resources were included within its parameters; the CBD confirms this in its guidance: *“Users of genetic resources include research institutes, universities and private companies operating in a wide range of sectors, such as pharmaceuticals, biotechnology, seed, crop protection, horticulture, cosmetics and personal care”* (Laird & Wynberg 2008).

Plant breeding is the main area of horticulture that was considered by ABS legislation and the Secretariat of the CBD also clarifies that whilst the majority of plant breeding is linked to the food sector the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) establishes, through Annex 1, its own ABS Multilateral System for 64 of the most important food security and forage crops. Thus these 64 crops fall outside of the ABS legislation of the CBD. This same guidance also clarifies that all genetic resources not covered by the ABS regime of the ITPGRFA comprise many food and agricultural crops and all ornamental crops (Wynberg 2013).

With 94% of varieties available in the global seed market subject to intellectual property protection and the global value of the horticulture trade in 2011 standing at US\$19 billion (around £12 billion based on average 2011 exchange rates (<https://www.exchangerates.org.uk/>)), these crops form a significant industry internationally (Wynberg 2013). In the UK, ornamental plants were worth £1 billion in 2016 (Department of the environment and rural affairs 2016). However, a report by the UK government’s Intellectual Property Office (the patent office) states that the ornamentals area of plant breeding is under-represented in data available on the economic importance and structure of the industry in ornamental plants (Intellectual Property Office 2016). Currently, 13 major breeders of ornamentals are active in the UK, however the number of breeders within this sector is difficult to quantify as they also include small scale breeders of ornamental flowers as well as private individuals

(Intellectual Property Office 2016). One of the major ornamental horticulture businesses in the UK, Thompson and Morgan, actively encourages individuals to submit newly discovered or bred plant varieties for trials with a potential £500 reward.<sup>1</sup>

The Intellectual property office's statistics also show that, with 1,249 Plant variety rights or Plant breeders' rights (PVR) in force for the UK in 2016, this area of horticulture is certainly not insignificant. The ornamentals sector has the majority of PVRs in force (835 or 66% of the total PVRs), whilst the rest are attributed to fruit and vegetable varieties (219 PVRs or 18%) and other agricultural crops (15%) (Intellectual Property Office 2016).

To date there are few examples of commercial horticulture implementing ABS, with only a small number of formal examples of an ABS agreement being made between a large-scale plant breeding organisation and a provider country under the terms of the CBD; Sunpatiens® was one such case. Sakata seeds, a Japanese company, originally formed a basic access agreement in the early 2000's to utilise the diversity of Indonesia's *Impatiens* species in its plant breeding program. Having researched and developed a product, using genetic material accessed from the country, a formal ABS agreement was developed with Indonesia and came into force on release of Sunpatiens® in 2006. Sakata pays *"a share of the SunPatiens® royalty proceeds to the Indonesian government and, in addition, performs technology transfer as non-monetary benefit sharing."* An updated agreement was made in 2014 after ABS was ratified in Indonesia and the international agreement came into force. Sakata seeds had previously entered into a similar agreement with Argentina through the development of the plant *Mecardonia* 'Magic Carpet'<sup>TM</sup> (Sakata seeds 2016).

Another example of an ABS agreement being formed between an ornamental plant breeder and a provider country is illustrated in another of the secretariat of the CBD's case study documents. The

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<sup>1</sup> See <https://www.thompson-morgan.com/discover-new-plants>, accessed 2018 for details.

agreement between the South African National Biodiversity Institute (SANBI), then the National Biodiversity Institute (NBI); a government funded organisation, and Chicago based Ball Horticulture, one of the world's largest Horticultural companies, made international news headlines at the time it was under discussion. The lengthy process of reaching the agreement was the first of its kind in the horticultural sector (Botanic Gardens Conservation International (BGCI) 2016). The agreement used the skills base at SANBI to select plants from its own collections and the wild for development by Ball. This agreement was reached after a protracted period of 3 years and 14 iterations yet nearing the end of the agreement process, concerns raised by NBI staff, NGOs and the permitting authority, The Western Cape Nature Conservation board, now CapeNature (WCNCA), led to a large, and negative, public and media response to the agreement. The way the agreement was handled, the lack of involvement on the part of local horticultural companies, the reluctance of the WCNCB to issue a blanket permit and an imbalance between the granted access and both the monetary and non-monetary benefits were all raised as concerns by stakeholders. The complications that arose were mostly down to the fact that there were little or no relevant processes, included in government policy frameworks, at the time for NBI to follow. In 2001, an NBI board meeting took place to review the agreement and concluded the agreement was a positive development in principle but stressed the insignificant financial and non-monetary benefits derived by NBI from the agreement. They also recommended that the agreement not be renewed unless renegotiated, and they highlighted the urgency for national legislation on the matter. The NBI certainly benefited from the agreement, however the non-monetary benefits outweighed the monetary benefits to the organisation and thus South Africa's biodiversity (BGCI 2016, Secretariat of the Convention on Biological Diversity 2006). This example of a commercial agreement to provide access to biodiversity highlights many aspects of the issues surrounding the CBD and ABS. One point that it does make is that of the 'insignificant [financial and] non-monetary benefits' offered as part of the agreement and this leads to the question of 'What non-financial benefits could, or does, commercial horticulture provide and to what extent?'

Crane (2013) proposes that, in the event of a new plant being discovered, the ability of the CBD to secure the species or, conversely, make it more vulnerable would depend on the attitude of the country of origin. He uses the example of the Wollemi Pine (*Wollemia nobilis*), a critically endangered species discovered in 1994, which, through the approach of the Government of New South Wales, has been marketed around the world, directly funding the conservation of the species in the wild (Crane 2013). Certainly, the case of the Wollemi pine is one where a financial benefit for the good of conservation has been raised from the commercialisation of an ornamental plant and could be used as an example for future commercialisation of plants that would lead to monetary benefits being returned to the origin country.

Illustrating the converse case to the Wollemi pine, Hinsley and Roberts (2017) looked at the extent of ABS in the wildlife trade and took the trade in South East Asian orchids as an example. Their findings showed that much of the trade in orchids in Asia was undertaken without any formal ABS agreements in place and supported concerns that there is limited awareness of ABS within the horticulture trade internationally. Their findings proposed that the countries of South East Asia are *“not benefitting equally from trade in their native species”* twenty years on from the introduction of the CBD. Hinsley and Roberts (2017) went on to identify several countries that would benefit in a longer-term manner from formal agreements to commercialise their native orchid species than those, informal agreements, that were already in place through the illegal wild collection of plants for the industry (Hinsley and Roberts 2017).

The case studies for the Wollemi pine and South East Asian orchids show that commercial horticulture has the ability to provide financial benefits to provider countries. They lead to two supplementary thesis questions surrounding whether the wider commercial ornamental horticulture

has the ability to provide such benefits, in return for access, to be shared with provider countries from the commercialisation of their native flora.

### 1.3 Wild Plants in Commercial Horticulture

Plant breeding and the horticulture industry source and utilise plants in several different ways from both cultivation and the wild. However, in all the case studies so far mentioned, with relation to horticulture, it was wild plant material that was utilised. Access to this material for development of a product or for the direct commercialisation of the material had to be gained to develop the commercial product. However, plants are traded internationally for ornamental horticulture without legal access agreements (Hinsley and Roberts 2017). When permits are not gained in order to collect and sell ornamental plant material from the wild, the trade becomes part of the broader illegal trade in wild plants (Phelps et al. 2015).

Rose's (2016) article, 'La biopiraterie, qu'est-ce que c'est?' (reproduced in English later as 'Biopiracy: when indigenous knowledge is patented for profit'), gives some classic examples of plants being sourced from their country of origin for the express purpose of commercial gain, including both tea (*Camelia sinensis*) and rubber (*Hevea brasiliensis*); in both cases bio-piracy has subsequently been claimed (Rose 2016). Robert Fortune was originally commissioned in 1843, by the Royal Horticultural Society (RHS), to explore and bring back specimens of plants from China, however, it was only through a secondary contract, and a quadrupling of his pay, with the East India Company, that he was commissioned to "*obtain the finest varieties of the tea plant ... for the government manufactures in the Himalayas*". In 1876 Henry Wickham brought rubber to the Royal Botanic Gardens, Kew, under a specific contract from the garden to do so (Woodward 2012). Fortune and Wickham were just two in an extensive list of plant hunters sent around the world to bring plants back to the UK for both commercial gain and scientific understanding. Most plant varieties found in a traditional British garden were introduced from across the globe by the endeavours of these plant

hunters and the article entitled 'The plant hunters: Adventurers who transformed our gardens would put Indiana Jones to shame' highlights some of these plants and the people that brought them into cultivation (Summerly 2012).

Initially, ornamental plants were introduced to gardens via the great botanic institutions of the time as a by-product of missions of a scientific nature. Subsequently there became a much more commercial aspect and nurseries, looking for financial gain, employed plant hunters to bring back new and exciting specimens to be introduced for sale. This industry is considered in depth in the book 'The Plant Hunters: The Adventures of the World's Greatest Botanical Explorers' (Fry 2009). The list of species introduced to commercial trade and horticulture by these 'plant hunters' and the institutions and commercial nurseries that employed them is extensive. James H. Veitch in his 1906 publication 'Hortus Veitchii; A history of the rise and progress of the nurseries of Messrs. James Veitch and sons (Veitch 1906), together with an account of the botanical collectors and hybridists employed by them and a list of the most remarkable of their introductions' gives an account of the extent to which this commercial trade in plants collected from the wild, and subsequently developed into a commercial product, took place during the 1800's and early 1900's. More recently 'The Hillier manual of trees and shrubs' has formed a similar catalogue for a commercial enterprise and in its first edition it listed more than 8,000 tree and shrub species and varieties available to the British gardener with the dates of their introduction and notes on their suitability for the garden (Lancaster 2017). The most recent edition lists 13,000 taxa of which 94 native species from the British Isles are listed.

These two books alone give just a small hint of the extent to which plants from across the world have been introduced to commercial horticulture and the introduction of new plants to this trade, from the wild, continues. The RHS annual publication 'The Plant Finder' lists "more than 70,000 plants" and where to find them for sale in UK garden centres and nurseries. The publication lists

many alongside their relevant collector's reference, abbreviations following a plant name referring to the collector(s) of the plants or the expedition during which they were collected. The publication also states clearly that "[under the terms of the CBD] collectors are required to have prior informed consent from the country of origin for the acquisition and commercialisation of collected material" (Cubey 2017, p.38). Nearly 300 collector's codes, signifying either individual collectors or expeditions, are listed within the publication giving some idea of the extent to which KWP plant material is traded within the UK horticultural market (Cubey 2017). With this in mind KWP plants certainly remain relevant and retain importance to commercial ornamental horticulture yet no literature was available that gave a clear indication of to what extent.

#### 1.4 What is Known Wild Provenance and why should it be considered important?

Page 54 of the guide, 'Principles of Horticulture: Level 3' (Adams et al. 2015), discusses provenance in the context of its relevance to cultivation and ornamental attributes. They give the definition of wild provenance as "*collected from the wild, unselected and taken from a wide area, registered with the 'source identified' or taken from a selected natural area*". They also define KWP material's relevance to ornamental horticulture through the statement "*Ornamental plant producers find provenance is significant on so far as there are considerable differences in plants taken from different areas notably with regard to: Hardiness, e.g. *Elaeagnus umbellata* 'Cardinal strain' grown in Britain and Ireland withstands temperatures down to freezing whereas those from Japan cannot. Characteristics, e.g. individual trees can vary greatly in their performance such as *Acer palmatum* for autumn colour, *Betula utilis* var. *jaquemontii* for stem whiteness. Pest and disease resistance, e.g. *Larix decidua* (larch) seed from Scotland seems highly resistant to larch canker whereas that from Central Europe is susceptible*" (Adams et al. 2015).

The attributes they mention all directly associate with desirability for plant breeding. The importance of access to a range of genetic material for this purpose is succinctly put by Plantum, the

Dutch association of companies that produce and trade seeds and plant propagating material, *“Plant breeding creates new plant varieties with better properties benefiting the farmer, grower, processing companies and consumers, based on genetic variation from existing varieties, from natural habitats and gene banks. Access to these genetic sources is important to ensure future breeder’s contributions to sustainability in horticulture and agriculture. Due to upcoming biodiversity regulations in the EU based on the Nagoya Protocol, such access may become very complex”* (www.plantum.nl 2014).

Provenance has also become a feature in calls for genetic diversity in urban trees to assist in the resilience of green infrastructure to climate change. With papers by Pounders et al. (2004), Gross et al. (2017), Watkins (2019) and Watkins et al. (2019) looking at how known provenance plants can be better adapted to future predicted climates and international calls for a better understanding of the role of provenance in sustaining urban ecosystems (Stevenson et al. 2020). Yet most large German, Dutch and UK tree nurseries did not know the provenance of the parental material that the trees they were selling were propagated from which suggested a commercial or regulatory barrier to producing plant material with KWP (Sjöman & Watkins 2020).

Based on a search of Google Scholar using the search term 'importance of known wild Provenance for commercial horticulture' in the first 10 pages of results only 12 papers were directly related to, and only two (Gross et al. 2017 and Thomas et al. 2015) discussed any, relevance of KWP to ornamental commercial horticulture with others discussing food resources, conservation and ecological restoration. Further results, Middleton & Vosloo’s (2011) ‘Sources of new ornamental plants: the importance of heritage plants and plant relicts from historic places and old gardens’ discussing the importance of plants of horticultural origin, and not wild provenance, for plant breeding and Kate & Wells’ (2001) ‘Preparing a national strategy on access to genetic resources and benefit-sharing’ only discuss ‘horticultural varieties’ when it comes to horticulture as users of genetic material. KWP does, however, prove relevant to other areas of horticulture with crop breeding being



the most widely discussed. However, although Brozynska et al.'s (2016) paper, 'Genomics of crop wild relatives: expanding the gene pool for crop improvement', and others touch on subjects that can be transposed to the area of ornamental horticulture, again, they do not bare suitably direct relevance to ornamental horticulture.

The area where KWP is discussed that appears to have most relevance to the ornamentals industry is that of conservation through ex-situ and restoration initiatives. During the chapter entitled 'The Role of Botanic Gardens in Ex-situ Conservation' in the book 'Plant Conservation Science and Practice: The Role of Botanic Gardens', Smith and Pence (2017) make it clear that provenance is integral to the conservation and research value of living collections. The genetic diversity held in living and seed bank collections is of utmost importance when conservation is considered. *"For effective conservation of a species, the collection should include enough genetic representation to replicate the diversity of the species in the wild in a restoration programme. Seed and spore banking can effectively store the genetic diversity of a species when collected from an accurate representation of populations and individuals."* Wild seed collections allow botanic gardens to conserve the genetic diversity at population level and Smith and Pence go on to say, *"All forms of ex-situ collections should have provenance documentation which can then be connected with any measured genetic diversity"* (Smith & Pence 2017).

Conservation is also cited as one of the main reasons for the continued introduction of new species and genotypes of plants with KWP by commercial nurseries. In the 2018 article 'Plants, Piracy and Preservation' the Financial Times author, Jonny Bruce, gives examples where commercial nurseries dealing in KWP plants have actively participated in a conservation role or actively provided benefits (although not through formal ABS agreements) to a country or institution (Bruce 2018). The restoration of the South African heath, *Erica verticillata*, to the wild is a good case study showing how the commercial horticulture trade can have a positive impact on the restoration of a species

that had become extinct in the wild. Whilst none of the multiple clones of *E. verticillata* used in the restoration of this species to the wild had guaranteed KWP, the provenance of at least some of them can be ascertained through botanic garden records and the history of introduction. One clone used in the reintroduction of this species was discovered in the collection of a commercial horticultural company and another in the collection of a private horticulturist (Hitchcock & Rebelo 2018).

Anthony Hitchcock, in his work towards the conservation and reintroduction of, *E. verticillata* gave each cultivated genotype an individual cultivar name so as to recognise it (Hitchcock & Rebelo 2018). This tool for identification allowed for genetic diversity to be managed and maximised within a small cultivated population. Additionally, research into *Castanea* spp. genetic diversity and conservation has used known cultivars to identify natural variation of a threatened species (Mellano et al. 2012).

After its discovery in 1994, in order to protect the species from plant hunters, the decision was made to commercialise the Wollemi pine (*Wollemia nobilis*). Birkdale Nursery alongside Queensland's Department of Primary Industries (Forestry) won the contract to propagate the Wollemi pines. Through a partnership research into the cultivation of the tree and development of the tree as a product was undertaken. Wollemi pine cultivation is now licensed to nurseries in Japan, the UK, New Zealand, Canada, the US and more. One aspect of this commercialisation process led to cuttings being taken from 15 individual wild *Wollemia nobilis*, marketed as 'The Collector's Edition' and sold in 148 lots at Sotheby's Auction House in 2005 raising significant income for the conservation of the species (Jamieson 2005). The idea that people were prepared to pay significant amounts for such a rare plant gives weight to the idea that plants of this nature are more valued and so, more valuable.

### 1.5 Credence: The Monetary Value of KWP

Several British nurseries sell, and even specialise in, KWP plants, with one nursery introducing over a hundred new species, genotypes and varieties of KWP plants annually (Crûg Farm 2018). Their

websites and catalogues form a valuable resource in understanding the trade in such plants. Many of these nurseries publish detailed notes, descriptions or blogs regarding the source of the plants and the expeditions made to collect them. The gardening public continues its interest in these plants of KWP for many and varied reasons and as 'The Patient Gardener' says in her 2015 blog about ABS *"For me this seems to herald a curtailing in the not too distant future of the tradition of plant hunting which some of us gardeners follow vicariously savouring the results with those special acquisitions"* (Johnstone 2015).

The Patient Gardener's blog (<https://patientgardener.wordpress.com/2015/03/06/the-future-of-plant-hunting/>) leads to two further questions regarding peoples' desire to grow wild provenance plants. 'Why do people grow plant material with KWP? And what is their motivation?' The subjective attitudes and perceptions that take a plant into being one of the 'special acquisitions' mentioned in The Patient Gardener's blog are difficult to quantify. The statement alludes to an intangible value or credence attribute associated with KWP plants. Can this value begin to be understood when other areas of horticulture and even other industries are considered? Searches of Google Scholar using the terms 'credence attributes ornamental horticulture' and 'ornamental plants consumer preferences' returned 5,640 results and 28,200 respectively, although only a proportion of these results were relevant, showed that a significant amount of research has been undertaken concerning consumer preferences in ornamental plants when attributes such as 'organic, local and sustainability' are concerned. Yue et al.'s 2011 article entitled 'Investigating Consumer Preference for Organic, Local, or Sustainable Plants' appeared on the first page of results for both searches.

Sustainable, local and organic are three attributes that are found across the sector that cannot be evaluated by the customer beyond the point of purchase (credence attributes). Yue et al.'s (2011) paper found that consumers were prepared to choose locally produced plants or those grown in sustainable packaging over others based purely on the way the plants were labelled (Yue et al.

2011). The credence attributes given to KWP that lead gardeners to see them as 'special acquisitions' could be likened to those given to the three niche areas of horticulture discussed. However, possibly more appropriate to the concept of credence attribution to KWP plants are those similarities that can be drawn between the antiques market and the market for wild orchids. *"Like Van Gogh art or Ferrari sports cars, rare orchids are exotic, expensive and appreciated not only for their vibrant colours and compelling lines, but also for a certain mystique"* (Ferrell 1995). The reasoning specialist collectors of antiques and orchids give as to why they collect these 'exotic, expensive or mysterious' items are very similar (Ferrell 1995) and may go a long way towards an understanding of the 'special' status of KWP plants for the gardener.

*"Collectors lust after a contraband orchid for the same reasons connoisseurs seek a forbidden manmade masterpiece, according to prosecutor Hochman: For its beauty, its rarity, its endangeredness."* is a quote picked up on and used to head a chapter by Mackenzie and Yates (2016 p.341). The quote places the two industries together under the same umbrella. In their paper they collected together market narratives and discuss some of the ideas that surround what drives orchid and antique collectors and what takes collectors into the realms of criminality. Mackenzie and Yates go on in their introduction with *"The personal and social processes of cultural edification within the moral economy of collecting orchids and antiques are explained by collectors through the use of narrative tools that seem to suggest a common pool of justificatory reference. From these vocabularies of motive (Mills 1940) operators in both collecting markets draw socially acceptable accounts to offer as explanations of why they break the law (Scott & Lyman 1968)"* (Mackenzie & Yates 2016, p.341). Mackenzie and Yates (2016) discuss throughout their writing some of the credence attributes associated with both antiques and orchids and in particular during the chapter entitled 'The Motivation to Collect' two quotes drawn from this chapter may mirror the influences associated with the market in KWP plants. The paper quotes Kersel (2015) in describing the impulse to collect antiques *"[collectors] may variously view themselves as connoisseurs, heroes, public*

*servants, saviours, tourists and harbingers of class*” (Mackenzie & Yates 2016, p.346) and likens it to the collection of orchids through the statement “*A large part of the idea of connoisseurship in collecting antiquities comes in the curation of a significant collection ... rarity, uniqueness and beauty are marks of both esteem and profitability and thus demand*” (Mackenzie & Yates 2016, p.343).

In their 2019 paper, Thomas-Walters et al. (2019) discuss some of the motivations behind the international wildlife trade. The paper looks at behavioural drivers of demand such as financial, experiential, social functional and spiritual. It is almost certain that ownership of KWP plants is driven by a number of the drivers listed:

- Experiential - Motivated by the desire to fulfil hedonistic pleasure, provide novelty, or satisfy curiosity
- Social - Motivated by the desire to form or strengthen social relationships
- Financial - Motivated by the desire for financial gain

The horticulturists need for KWP plants in a pursuit of the three values of *‘rarity, uniqueness and beauty’* (Mackenzie & Yates 2016, p.343) in an industry dominated by conformity certainly falls into the experiential driver. Whilst the motivation to collect, and be esteemed for curating, such a collection is as much of a social driver in the world of ornamental garden plants as it is in the world of antiques with people that grow KWP plants seeing themselves as *‘connoisseurs, heroes, public servants, saviours’* (Mackenzie & Yates 2016, p.346). These two drivers lead to a financial driver involved in the trade in KWP plants.

If, like other industries, plants of KWP carry social and experiential value or credence attributes then the belief that these plants are special leads to a question regarding what monetary value may be attributed to these plants. Whilst there is literature surrounding such values for other market areas no literature was found to answer such questions.

## 1.6 The Potential for Non-monetary benefits

The Patient Gardener's blog is just one reaction to the subject of ABS (Johnstone 2015). The world of commercial horticulture has responded to the idea of the legislation in many ways. The overriding feeling towards the legislation has been one of suspicion and negativity. Certainly, the article written on the subject entitled 'Nagoya Protocol: plant hunters need to step up to this new challenge' for the Guardian's Gardening section (Blackhall-Miles 2015) attracted interest from the sector and the comments section showed that there was at the time a significant amount of misunderstanding and misinterpretation regarding the legislation. It is as part of these comments that a discussion unfolds regarding the legislation and several specific points are discussed.

As an outcome of the realisation that the protocol would have an impact on the commercial horticulture sector, a meeting was organised by the RHS and attended by over 50 representatives from across the horticulture industry (The Royal Horticultural Society 2015). This meeting led to the creation of a working group that aims to create clarity for the sector and in time the group issued a statement (Appleby 2016, The Royal Horticultural Society 2016) that clearly recognised the need for more understanding of the implications to the sector of ABS.

It was during this time that the BBC released its article 'Illegally collected Himalayan plant seeds sold in UK' covering an investigation into the illegal acquisition and distribution, by one of Britain's most respected plant societies, of seed from Sikkim. Whilst the article clearly stated that the seed had been collected without the relevant permits in place it also stated, "*The Nagoya Protocol, an international treaty that came into being in 2014, prohibits the collection of plant materials without an agreement with host countries on the sharing of benefits arising from such resources*" (Khadka 2016). This statement created a new wave of confusion about the specifics of the protocol and its ABS instrument. This has subsequently led to a number of plant societies publishing statements regarding their position on ABS. The most in depth of these being that of the AGS (Alpine Garden

Society URL:<http://www.alpinegardensociety.net/>). The AGS's review of the international laws that surround collection of plants from the wild and their use is extensive and gives a broad overview of all the legislation that affects the trade in wild plant species (Richards 2015).

The Hardy Plant Society (<http://www.hardy-plant.org.uk/>) created a similar statement regarding donations of seed to its seed list and asked its members to comply with ABS regulations through issuing the following statement *"Any seed collected from the wild after October 2014 from a country which has ratified the Nagoya Protocol must have been collected in accordance with the Protocol and can only be offered to third parties if that is permitted by the contract between the collector and the source country. The Hardy Plant Society requires any person donating wild-collected seed to confirm that they have complied with the requirements of the Nagoya Protocol and that the agreement they have with the source country permits the sharing of the seed in this way"* (Rollinson 2015).

Whilst the plant societies followed the route of creating statements to ensure their compliance with the legislation, commercial nurseries and the plant breeding industry had their own responses.

Plants for Europe Ltd, a breeders' rights agency service for garden plants, made the obligations of plant breeders clear through a comparatively simple statement on their website *"Breeders and growers must ensure that they are compliant with the requirements of the Nagoya Protocol. Plant material must be traceable to a permitted point of origin, whether it is to be propagated as is or used in a breeding programme. Failure to exercise due diligence in this regard could result in you not being able to market and promote the plant material concerned or anything bred from it"* (Spencer 2016a).

Other areas of the industry chose different responses and some nurseries built the regulation into their conditions of purchase (e.g. Crûg Farm Plants 2016). Tom Mitchell, then of Evolution Plants nursery, took to social media on a number of occasions to write about the CBD and ABS

*"Unfortunately, the UK has signed and ratified the Nagoya Protocol to the Convention on Biological Diversity. Almost no-one knows and still fewer care, but this is a massively retrograde step in the war*

*to save biological diversity. Masquerading as an effort to share the benefits accruing from 'genetic resources' fairly, in fact it nationalises biodiversity and places it in the hands of corrupt politicians and bureaucrats. To the extent it is implemented, it will hobble ex-situ conservation efforts"* (Mitchell 2016b). Mitchell went on to give lectures on the subject to numerous organisations and at several large gardening events (Appleby 2015). He expands upon his opinions of the protocol and the CBD as part of his blog on *Galanthus trojanus* and its conservation (Mitchell 2016a). The assumed negative impact to conservation of the protocol was also cited on plant hunter Kenneth Cox's Glendoick Garden Centre's website as one of the reasons for giving up on the mail-order side of the business. *"The Nagoya Protocols, which bans plant collecting worldwide, have made plant-hunting for a nursery like ours more or less impossible. While we quite understand the reasons for this legislation, and broadly support it, the effect is likely to be counter-productive in terms of conservation, as threatened plants may become extinct, if they cannot be collected and distributed. We were lucky to have three generations of Cox plant-hunters"* (Cox 2017).

The potentially negative conservation impacts arising from the cessation of the collection and distribution of plants and seed caused by the CBD and its acknowledgement of individual countries jurisdiction over genetic resources and its ABS legislation, is a running theme in all the opinions of the 'plant hunting' area of commercial horticulture. From blogs, mainstream media and forum conversations (The Scottish Rock Garden Club Forum 2016) it is clear that there is a lack of understanding of and a general negativity towards the legislation. Again, the question 'What benefit to ex-situ conservation do wild seed collections for commercial horticulture have?' arises and are those using conservation as an argument for continued access right to make such an assumption of the negative impact of ABS?



## 1.7 Discussion

Whilst there is certainly sufficient written in books and the grey literature (e.g. media articles, blogs, social media) on the subject of plant hunting for commercial horticulture there is little peer reviewed research available to begin to answer the research question that has shaped this thesis. With little research having been conducted regarding how commercial nurseries may provide benefits to the countries from which seed is accessed and the wider impacts this may have for international conventions such as the Global Strategy for Plant Conservation (GSPC) further research was deemed necessary. Provider countries may also be unaware of the benefits that allowing access to genetic resources for commercial horticulture may bring.

This exhaustive review of the literature raises a number of supplementary questions that allow the wider question of **'Plant hunting for commercial horticulture and access and benefit sharing: complementary or competitive uses of wild novel plants?'** to be answered.

1. The literature reviewed in section 1.3 shows that KWP plants are of importance and relevance to commercial ornamental horticulture, but to what extent is the industry reliant upon them?
2. Do the cases of the Wollemi pine and the trade in the wild orchids (discussed in sections 1.2, 1.4 and 1.5) lead to the idea that there may be price premium for plants of KWP compared to plants from horticultural origin?
3. If plants of KWP are valued more highly than those of horticultural origin and consumers are prepared to pay more for these plants could this premium be translated into monetary benefits for the countries providing access to plant material to use toward conservation?

Section 1.6 of the review found that allowing commercial horticulture to access plants from the wild legally may lead a non-monetary benefit to provider countries in the form of conservation.

4. Can the availability of KWP plants in ornamental commercial horticulture assist in meeting the obligations of internationally agreed ex-situ conservation targets?
5. If so, can conservation be considered as a potential non-monetary benefit to provider countries in return for access to KWP plant material for commercialisation?

The legal supply of plants with KWP could have a positive impact on the reduction of the global market in wild plant species and this is evidenced by the case of the Wollemi pine. However, to enable this to happen nurseries need to be enabled to access such material and this has to come with agreement of the provider countries under terms that are agreeable to both parties.

International conventions such as CITES allow for the artificial propagation of listed plants such as orchids, cyclamen, snowdrops or carnivorous plants. Additionally, with calls for increased genetic and species diversity to be made available to commercial horticulture to enable resilience to climate change demand for KWP plants may grow. This increased demand for access to a wider range of intraspecific plant material of known provenance will rely on the ability of both the users (in this case commercial ornamental horticulture) and provider countries to reach agreement.

A better understanding of the range of benefits commercial horticulture could provide, both monetary and non-monetary, will smooth the way for this legal access under mutually agreed benefit sharing arrangements. Thus, the aim of this thesis, is to investigate how plant hunting for commercial horticulture can be successfully combined with the legislation regarding access and benefit sharing. The aim of the following chapters is to attempt to answer these supplementary questions with chapter 2 forming a preliminary assessment with regard to Questions 1, 4 and 5 and chapter 3 attempting to answer question 2 and 3.

## Chapter 2: A preliminary study into the Current Prevalence in UK Commercial Horticulture of Wild Provenance Plants and their Potential Benefit to Plant Conservation.

### 2.1 Introduction

In the UK, ornamental plants were worth £1 billion in 2016 (Department of the environment and rural affairs 2016). 13 major breeders of ornamental plants are active in the UK; however, these are swelled by a significant number of small-scale breeders and private individuals (Intellectual Property Office 2016). Most plant species found in British gardens were introduced from across the globe by the endeavours of plant hunters with those plants going on to provide the wide range of hybrids and cultivars now available. The list of species introduced to commercial ornamental horticulture by these 'plant hunters', and the institutions and commercial nurseries that employed them, is extensive and the introduction of new plants to this trade, from the wild, continues. The RHS annual publication 'The Plant Finder' lists "more than 70,000 plants" and where to find them for sale in UK garden centres and nurseries. The publication lists many alongside their collector's reference; abbreviations following a plant name referring to the collector(s) of the plants or the expedition during which they were collected. The publication also states clearly that "*[under the terms of the CBD] collectors are required to have prior informed consent from the country of origin for the acquisition and commercialisation of collected material*". Over 320 sets of initials, signifying either individual collectors or expeditions, are listed within the publication giving an indication of the extent to which KWP plant material is traded within the UK horticultural market (Cubey 2017).

Chapter 1, the literature review, found that such plants are of relevance to commercial ornamental horticulture yet could not determine to what extent they are of importance. The aim of this chapter is to provide an exploratory analysis of the RHS Plant Finder data to understand the extent to which KWP plant species are commercially available within those nurseries that list the plants they sell within the publication.

This chapter also aims to understand if the plants that are available could be used to provide a non-monetary benefit in the form of plant conservation to provider countries. To date there are few examples of commercial horticulture implementing ABS with only a small number of formal examples of an ABS agreement being made between a large-scale plant breeding organisations and a provider country under the terms of the CBD, one such agreement, in part, relies on non-monetary benefit sharing to form part of the agreement (Sakata seeds 2016). Another was disputed legally with 'insignificant non-monetary benefits' being cited as one of the reasons for the legal challenge (BGCI 2016, Secretariat of the Convention on Biological Diversity 2006). In the case of the Wollemi Pine (*Wollemia nobilis*), a critically endangered species discovered in 1994, commercialisation has brought monetary benefits funding the conservation of the species in the wild (Crane 2013). Yet the ability to purchase the plants legally has also brought with it the non-monetary benefit of removing the potential for an illegal trade in the species. Certainly, the case of the Wollemi pine is one where its conservation has benefited, both monetarily and non-monetarily, from the commercialisation of it as an ornamental plant and could be used as an example for future commercialisation of plants that would lead to monetary benefits being returned to the origin country.

With so few examples of the potential for commercial horticulture to provide benefits to countries that provide access to biodiversity for commercialisation the question of 'What non-financial benefits are available from commercial horticulture to provider countries in return for access to genetic resources and to what extent?' is highlighted.

The area where KWP is discussed that appears to have most relevance to the ornamentals industry is that of conservation through ex-situ and restoration initiatives. Provenance is integral to the conservation and research value of living collections. Wild seed collections allow botanic gardens to conserve genetic diversity at a population level. Conservation is cited as a reason for continued plant

hunting for commercial horticulture (Bruce 2018). The ability of commercial horticulture to supply plants of threatened species with KWP to botanic gardens for the purpose of conservation, thus assisting in the realisation of international plant conservation targets, may be perceived as a potential benefit to provider countries. Yet only in a small number of cases has a threatened plant species' availability in commercial trade has been shown to have positively impacted plant conservation initiatives (Crane 2013, Hitchcock & Rebelo 2018). Whilst there is lots of anecdotal evidence for commercial horticulture being able to offer conservation as a non-monetary benefit in return for access to wild plant material the literature review found little data to support this option.

The GSPC is an internationally agreed set of targets for plant conservation and was adopted in 2002 by the world's governments as a programme under the CBD. As part of Objective II of the GSPC, Target 8 requires that 'At least 75 per cent of threatened plant species in ex situ collections, preferably in the country of origin, and at least 20 per cent available for recovery and restoration programmes.' Botanic gardens and seed banks are the main institutions involved in the ex situ conservation of wild plant diversity. The combined plant collections held in botanic gardens consist of more than 100,000 species, nearly one third of all known plants, including many threatened species (Mounce et al. 2017). These are documented in BGCI's PlantSearch database which is used to assess progress towards this target.

An estimated 391,000 plant species are known and of the species with a global assessment listed in ThreatSearch, 37% were assessed as threatened with predictions suggesting that a similar proportion of known plant species may be threatened with extinction (Lughadha et al. 2020).

The limiting element of ex-situ conservation in Botanic Gardens and seed banks is funding and, for ex-situ conservation, the costs involved in the introduction and maintenance of living plants in

botanic gardens can be high. One of the highest of these costs is the introduction of species to collections with wild seed collections incurring significant outlay (Griffith & Husby 2010) up to US\$2,100 per seed collection (Li & Pritchard 2009). Additionally, the cost of identifying which plant species are threatened with extinction has been estimated at US\$17,000,000 (Stuart et al 2010) and the overall costs of plant conservation are currently unknown.

The literature review also found that allowing commercial horticulture to access plants from the wild legally may lead to a non-monetary benefit to provider countries in the form of conservation. Here an attempt is made to answer the questions 'Can the availability of KWP plants in ornamental commercial horticulture assist in meeting the obligations of internationally agreed ex-situ conservation targets?' and in turn 'Can conservation be considered as a potential non-monetary benefit to provider countries in return for access to KWP plant material for commercialisation?'

Subsequently the questions this chapter attempts to answer are:

1. The literature reviewed in section 1.3 shows that KWP plants are of importance and relevance to commercial ornamental horticulture, but to what extent is the industry reliant upon them?
2. Section 1.6 of the review found that allowing commercial horticulture to access plants from the wild legally may lead a non-monetary benefit to provider countries in the form of conservation. Can the availability of KWP plants in ornamental commercial horticulture assist in meeting the obligations of internationally agreed ex-situ conservation targets?
3. Can conservation be considered as a potential non-monetary benefit to provider countries in return for access to KWP plant material for commercialisation?

In order to answer these questions an exploratory analysis of data from the RHS PlantFinder alongside BGCI's Threat Search data was undertaken. The inferred global threat statuses (GTS) held by BGCI's ThreatSearch were used in preference to the IUCN Red List data due to the limited number of vascular plant species assessed for the IUCN Global Red List and that the GTS figure of 26,118 species is based on this data set.

The main contributions to the literature are:

- a) An understanding of the range of plant species available to commercial horticulture during a fixed period of time
- b) The number of those that have KWP information attributed to them
- c) What part of the range of available plants is considered threatened in the wild
- d) Whether those plants could be considered available for ex-situ conservation and restoration thus showing whether plants available for sale are available to meet the responsibilities of target 8 of the GSPC.

## 2.2 Data Collection

The RHS Plant Finder is an A-Z directory of 76,000 species, varieties and cultivars of plants and where they are available for sale. First published in 1987, and published once a year since, the RHS Plant Finder lists the plants available from more than 470 nurseries across the UK and Europe and provides a snapshot of those garden plants available commercially in Britain.

We used the data held in the RHS Plant Finder to ascertain the importance of KWP plants for the UK horticulture industry and assist in answering the question 'To what extent are KWP plants available in UK Commercial horticulture?' By understanding the diversity of plant species available for sale in

UK nurseries and what percentage of those plants have KWP, we can go some way towards ascertaining the market share these plants may have.

For the purpose of this study the 2018 edition of the RHS Plant Finder was used as a source of data and was provided electronically under a licence agreement by the RHS. This data acted as a snapshot of the species available to the UK horticultural industry and covered stock listings uploaded by 470 nurseries across the UK and into Europe. 76,000 plant taxa were listed in the 2018 RHS Plant Finder, covering a range from species to intraspecific hybrids, intrageneric hybrids, varieties and named cultivars of plants. 3,400 new plant varieties were listed as being available for sale during 2018.

Plant names used in the 2018 RHS Plant Finder reflect the decisions made by the RHS Nomenclature and Taxonomy Advisory Group. Where a plant is considered widely available i.e. listed in more than 30 nurseries the plant name is entered into the RHS Plant Finder, but the nursery list is not given.

The following two separate sets of data from the RHS Plant Finder were requested from the RHS these were:

- a full list of species available (which included those species listed with a cultivar name).
- List of species offered with KWP

A cultivar is considered to be a cultivated variety of a species and a cultivar name is given to denote variation within an individual species. For the purpose of the data requested, where a species is shown as available with multiple cultivars only the species was included in the data.



KWP plants were those listed alongside their collector's reference. A collector's reference is an abbreviation usually with numbers following a plant name and normally refers to the collector or expedition during which the plant was collected. The Collector's reference may indicate a new, as yet unnamed range of variation within a species. Where a species is shown as being available as multiple cultivars or with a collector's reference the species was considered as being available with KWP.

RHS Plant Finder data was analysed to determine how many plant species were available and how many were available with KWP data. Analysis was undertaken across a range of genera within different horticulturally important plant groups, as used by the RHS (URL.

<https://www.rhs.org.uk/plants/types>), was conducted to understand what percentage of each genus was available for sale and what percentage were offered with KWP. Plants of the World online (URL. <http://www.plantsoftheworldonline.org/>) was used to ascertain the number of species in each genus.

The data from the RHS Plant Finder was then compared to BGCI's ThreatSearch database (under a licence agreement with BGCI) to understand the range of threatened species listed as available in commercial cultivation during 2018. This, in turn, allowed an understanding of what proportion of threatened members of an individual genus are available for sale, and subsequently cultivated. In order to understand if commercially available threatened plant species make their way into ex-situ collections that count towards international targets, a case study analysis for the genus *Quercus* (Oaks), was undertaken through a survey of UK collections that hold Globally Threatened *Quercus* spp. listed in the RHS Plant Finder (for the purpose of this study 8 *Quercus* spp. listed as available under synonymised names were not included). The genus *Quercus* was chosen due to their global ethnological, ecological and economic importance, the level to which the genus is threatened with extinction, the strong representation of the genus in ex situ collections within botanic gardens and

commercial horticulture and, finally, the requirement of oaks to be conserved as living specimens as opposed to being conserved as seed banked specimens.

### 2.2.1 Ex-situ survey of Globally Threatened *Quercus* spp. listed in the RHS PlantFinder

Given the RHS Plant Finder only lists plants available in UK (and a small number of European nurseries that ship to the UK), an online survey (using SurveyMonkey.co.uk) was conducted for those UK botanic gardens and arboreta with collections that held *Quercus* spp. listed in the RHS Plant Finder with a GTS. Information regarding which institutions held *Quercus* spp. was available through institutional access to the BGCI PlantSearch database; the author has access to the members area of this database due to institutional membership of BGCI.

13 UK collections held one or more of the *Quercus* species and data regarding these collections was held across 10 collection databases; due to multiple collections being managed by an individual organisation i.e. The Royal Botanic Garden Edinburgh, Logan Botanic Garden, Dawick Botanic Garden and Benmore Botanic Garden collections are held on a single database (BGCI PlantSearch, accessed 2018).

### 2.2.2 Survey design

A simple multiple-choice survey (Appendix 2) was sent directly to curators at each of the institutions holding *Quercus* spp. (using SurveyMonkey.com) that asked the question '*Do you grow any of the following Quercus species and, if so, from where were they sourced?*'

- *A Botanical garden or institution*
- *A private collection*
- *A commercial nursery*

- *Seed or plant from the wild*
- *Don't know*
- *Not in the collection*

The survey contained a tick box list of *Quercus* species and asked the secondary question '*In which country is your garden located?*' to ensure only UK gardens responses were used as part of the analysis. The survey was sent directly via a link embedded in an email to data management contacts at each of the 10 UK institutions.

### 2.3 Summary statistics of Plant Finder Data for KWP

16,300 individual species of plants were offered in Plant Finder during 2018, amounting to 21.5% of the total number of taxa offered; the remaining taxa were a combination of hybrids and non-specific cultivars. Of these plant species 1,705 species were available for sale with KWP, this is equal to 10.5% of the species available for sale or 2.2% of the total range of taxa (including cultivars, varieties and hybrids) offered. The majority of genera ( $n = 199$ ) with KWP were herbaceous perennials with the next largest group being trees and shrubs ( $n = 183$ ) as shown in Figure 2.1. Of the top 10 genera the greatest number species available with KWP were 'Trees or Shrubs' or 'herbaceous perennials' (Figure 2.1).

Figure 2.1. Number of genera with KWP in each of the horticultural plant groups<sup>2</sup> used

Plant group	Number of genera
Bulbs	24
Ferns	7
Grasses (Including Bamboo)	13
Herbaceous (Inc. herbaceous vines)	199
Trees and Shrub (Inc. woody vines, <i>Magnolia</i> , <i>Rhododendron</i> )	183
Tender	6

<sup>2</sup> URL. <https://www.rhs.org.uk/plants/types>

Figure 2.2. Top 10 genera (including natural hybrids) available in RHS Plant Finder with KWP in rank order

Genus	No. of species in Plant Finder available with KWP	% of species in Plant Finder available with KWP	Plant type
<i>Rhododendron</i>	50	12.79%	Tree or shrub
<i>Viburnum</i>	44	53.01%	Tree or shrub
<i>Sorbus</i>	44	37.29%	Tree or shrub
<i>Acer</i>	35	38.89%	Tree or shrub
<i>Epimedium</i>	31	53.45%	Herbaceous
<i>Hydrangea</i>	27	96.43%	Tree or shrub
<i>Helleborus</i>	26	96.30%	Herbaceous
<i>Polygonatum</i>	25	49.02%	Herbaceous
<i>Thalictrum</i>	21	38.18%	Herbaceous
<i>Salvia</i>	21	6.80%	Herbaceous
<i>Rubus</i>	21	36.21%	Tree or shrub
<i>Cotoneaster</i>	21	10.24%	Tree or shrub
<i>Aconitum</i>	21	43.75%	Herbaceous
<i>Schefflera</i>	20	95.24%	Tree or shrub
<i>Aralia</i>	19	79.17%	Tree or shrub

Figure 2.3. Descriptive statistics for a range of commonly grown horticultural plant groups<sup>2</sup>

Plant type	Genus	No. of spp. in genus <sup>1</sup>	No. of spp. in RHS Plant Finder	% of spp. in RHS Plant Finder	No. in RHS Plant Finder with KWP	% in RHS Plant Finder with KWP	% of total spp. with KWP
Tree or shrub	<i>Rhododendron</i>	1,057	391	37.0	50	12.8	4.7
Tree or shrub	<i>Magnolia</i>	319	55	17.2	12	21.8	3.8
Tree or shrub	<i>Quercus</i>	453	137	30.2	7	5.1	1.6
Carnivorous	<i>Sarracenia</i>	12	12	100.0	0	0.0	0.0
Spring bulb	<i>Narcissus</i>	69	46	66.7	2	4.4	2.9
Summer bulb	<i>Gladiolus</i>	283	61	21.6	0	0.0	0.0
Alpine Herbaceous	<i>Saxifraga</i>	465	88	18.9	2	2.3	0.4
Spring Herbaceous	<i>Helleborus</i>	21	21	100.0	11	52.4	52.4
Summer Herbaceous	<i>Iris</i>	299	121	40.5	14	11.6	4.7
Tender	<i>Aloe</i>	575	71	12.4	0	0.0	0.0
Grass	<i>Miscanthus</i>	15	10	66.7	2	20.0	13.3

<sup>1</sup> data from Plants of the World Online, accessed 2019

<sup>2</sup> URL. <https://www.rhs.org.uk/plants/types>

Two of the 11 genera analysed had 100% of the species available commercially in 2018 (Figure 2.3). Of those genera analysed, smaller genera (<100 spp.) had a larger percentage of species available commercially. *Sarracenia* and *Helleborus* are small genera with 12 and 21 species respectively; each had 100% of species listed as available in the Plant Finder. *Narcissus* and *Miscanthus* are also small genera with 69 and 15 species respectively, each of which had over two thirds of their accepted species available commercially in 2018. *Helleborus* had over half of those species listed available with KWP, as all species in the genus were available commercially over half of all *Helleborus* species were available with KWP. Larger genera had a lower percentage of species available commercially. Two of the larger genera (*Iris* and *Rhododendron*) had over a third of species available with 121 and 391 species respectively. Five of the 11 genera analysed had 10% or more of those species listed in the RHS Plant Finder available with KWP. Three genera (*Sarracenia*, *Gladiolus* and *Aloe*) had no species available with KWP.

#### 2.4 Descriptive statistics for Plant Finder data and the Potential Conservation Benefit

The 2018 RHS Plant Finder lists 4.2% (n = 16,300) of the world's 391,000 vascular plant species, and of these, 1,705 plant species were available with KWP representing 0.4% of the world's plant species. Of the total number of species listed, both with and without KWP, 1,118 were found to have a GTS, equivalent to 4.1% of the total number of plant species listed on BGCI ThreatSearch an GTS (Figure 2.4). Further, 7.9% (n = 88) of the plant species with a GTS that were listed in the Plant Finder have KWP (Figure 2.4). 84.9% of those with an inferred global threat status that have KWP are represented in collections on BGCI plant search leaving 13 (14%) of the 88 not represented in botanic gardens on Plant Search. It is important to note that there is no data available to determine if the botanic garden network has information on the wild provenance of the material of these

species that they hold. A more detailed evaluation (Figure 2.5) was also made of those horticultural plant genera analysed as part of the Analysis of RHS Plant Finder Data for KWP (Figure 2.3).

Figure 2.4. Comparison of total number of threatened plant species with those threatened plant species available in RHS Plant Finder and those available with that are both threatened and have KWP

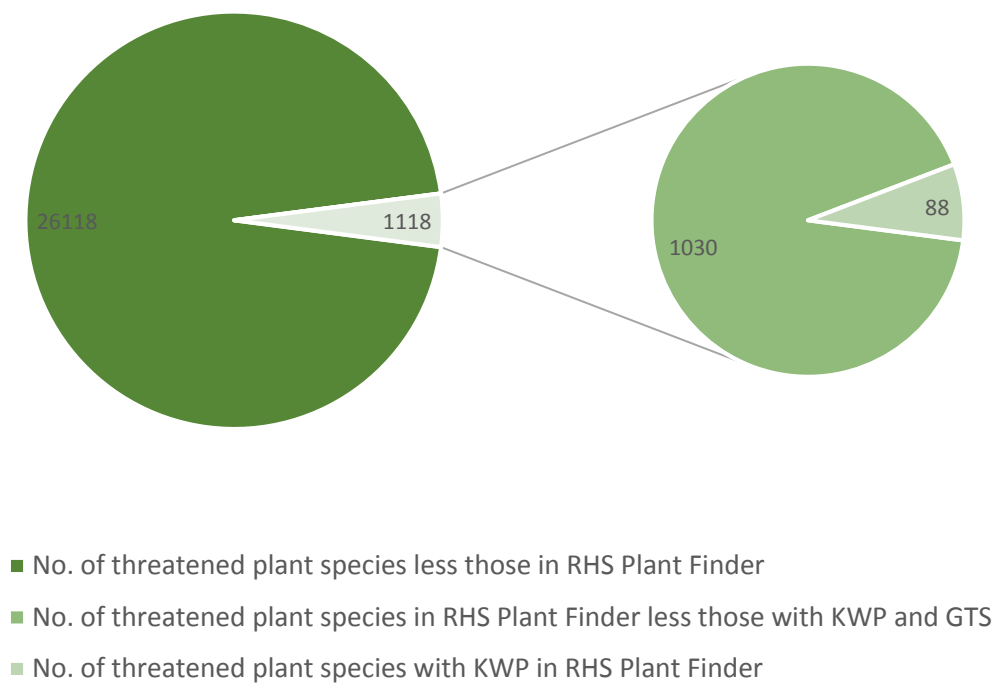




Figure 2.5. Analysis of interpreted GTS across a range of commonly grown horticultural plant groups<sup>2</sup>

Plant type	Genus	Total no. of spp. in genus <sup>1</sup>	Estimated no. of total spp. with GTS <sup>2</sup>	% of total spp. with GTS	no. of spp. with GTS listed in PF	% of spp. with GTS listed in PF
Rhododendron	<i>Rhododendron</i>	1,057	316	29.9%	122	38.6%
Magnolia	<i>Magnolia</i>	319	147	46.1%	39	26.5%
Tree or Shrub	<i>Quercus</i>	453	108	23.8%	29	26.9%
Carnivore	<i>Sarracenia</i>	12	5	41.7%	5	100%
Spring bulb	<i>Narcissus</i>	69	21	30.4%	5	23.8%
Summer bulb	<i>Gladiolus</i>	283	60	21.2%	3	5.0%
Alpine Herbaceous	<i>Saxifraga</i>	465	26	5.6%	1	3.9%
Spring herbaceous	<i>Helleborus</i>	21	5	23.8%	5	100%
Summer herbaceous	<i>Iris</i>	299	49	16.4%	5	10.2%
Tender	<i>Aloe</i>	575	115	20.0%	16	13.9%
Grass	<i>Miscanthus</i>	15	0	0.0%	0	0%

<sup>1</sup> data from Plants of the World Online, accessed 2019; <sup>2</sup> data from BGCI Threat Search accessed March 2020

<sup>2</sup> URL. <https://www.rhs.org.uk/plants/types>

Two of the eleven genera, *Sarracenia* and *Helleborus*, had 100% of their species with GTS represented in the RHS Plant Finder and three, *Rhododendron*, *Magnolia* and *Quercus*, had over a quarter of their species with a GTS listed in the RHS Plant Finder (Figure 2.5).

## 2.5 Case study: the impacts for a genus of conservation concern

*Quercus* is a genus of trees and shrubs, in the family Fagaceae, commonly known as oaks. There are 453 (Plants of the World Online accessed 2019) extant species of oaks. Oaks are of global ethnological, ecological and economic importance. Many species of oak are threatened with extinction internationally due to land use changes, livestock grazing and unsustainable harvesting (Oldfield & Eastwood 2007). There are 108 globally threatened oak species (BGCI ThreatSearch accessed 2018).

Oaks are relatively well represented in ex situ collections within botanic gardens and arboreta and BGCI's PlantSearch Database records around 240 oak taxa as occurring in living collections (BGCI PlantSearch, Accessed 2018). Such collections are valuable as an insurance policy against extinction. oak seeds are not able to be conserved under conventional seed bank conditions as they are recalcitrant and as such living collections of oaks are important for the genus' conservation, these living oak collections provide ex-situ options for conservation and research (Kramer & Pence 2012).

### 2.5.1 Analysis of *Quercus* in Commercial Horticulture

Over half of the number of *Quercus* species found in living collections, 137 were listed as available for sale in the RHS Plant Finder in 2018 (Figure 2.6 & Appendix 1). Of these 29 (21.2%) were GT, this figure is equal to over a quarter (26.9%) of the 108 globally threatened Oak species (Figure 2.7). All

29 GT species of *Quercus* listed in the RHS Plant Finder were listed as being in a UK Botanic Garden or Arboretum.

Figure 2.6. Comparison of *Quercus* species available for sale, in ex-situ conservation and total number of *Quercus* species (based on 2019 data)

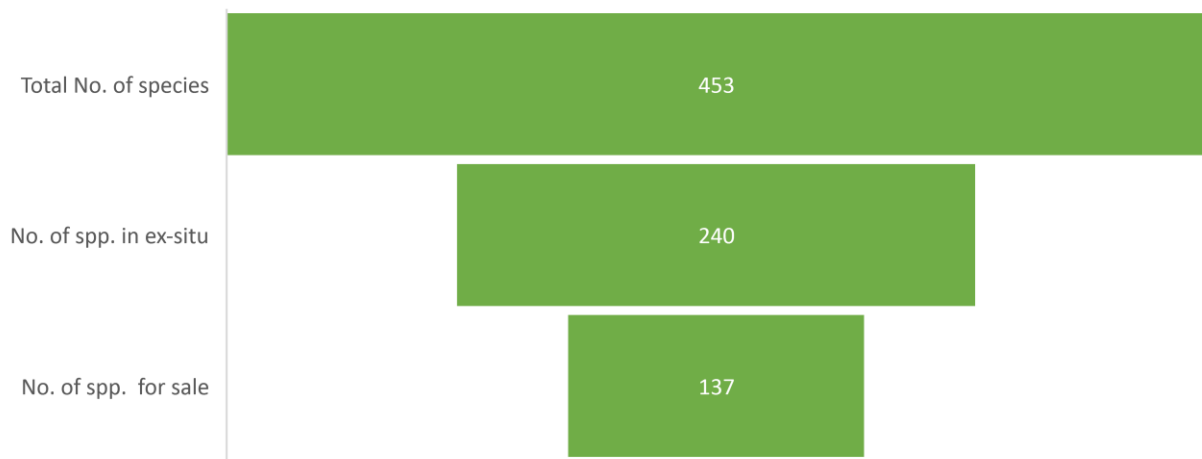
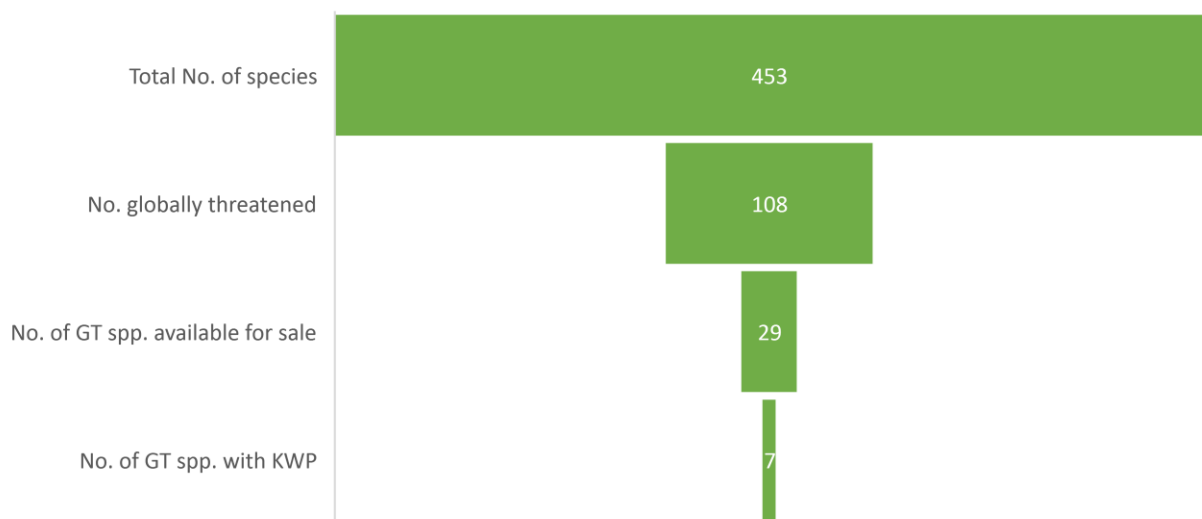


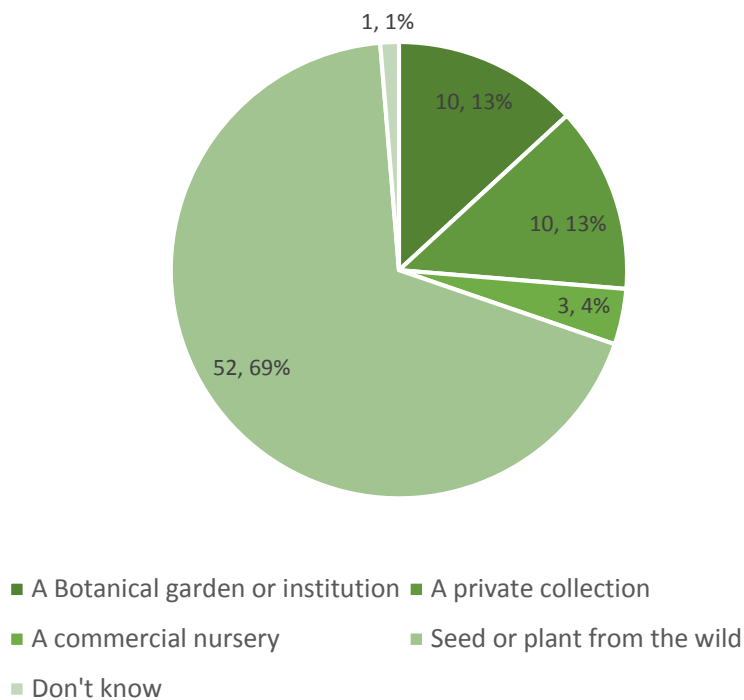
Figure 2.7. Comparison of GTS *Quercus* species to total number of species and those with a GTS listed in RHS Plant Finder 2018 and with those GTS species listed in RHS Plant Finder 2018 with KWP (based on 2019 data)



### 2.5.2 Descriptive statistics and analysis

A total of 7 responses were received. 28 of the 29 GTS oaks listed as available in the RHS Plant Finder were found in respondent collections across 76 accessions. Only one (*Quercus benthamii* A.DC.) was not found in the respondent collections. The majority (69%) of oak accessions across these collections came directly from wild sourced material and thus form a significant KWP resource for ex-situ oak conservation for those species considered in the study. A further 26% came from another botanic garden, arboretum or private collection for which no further information is available regarding the KWP of the plants or the nationality of the source collection. Only 4% (3 accessions) came from commercial horticulture and no KWP data is known for those plants accessed from commercial horticulture by ex-situ collections (Figure 2.8).

Figure 2.8. Number and % of *Quercus* accessions held in ex-situ collections from individual sources



## 2.6 Discussion

The RHS Plant Finder data, through its listing of plants alongside their collector's codes, shows that Plant hunting remains a source of novel plant species and varieties over 200 years after its heyday in the 18<sup>th</sup> and 19<sup>th</sup> centuries with nurseries still offering plants alongside their KWP. The publication lists 1,705 plant species alongside their KWP information and with this in mind it is demonstrable that the trade is still reliant on the introduction of such plants. Analysis undertaken shows that about one in 10 (10.5%) of the species (c. 16,300) listed as available in the RHS Plant Finder have KWP. This analysis clearly shows KWP plants still play a part in the ornamental commercial horticulture sector in the UK and provides an insight into the potential importance of KWP plants for commercial horticulture. These descriptive statistics go some way towards answering the question: To what extent are KWP plants available in UK commercial horticulture?

Whilst this acts as an indicator of the market for KWP plant material, to gain a full understanding of the reliance of commercial horticulture on KWP plants and their market share, sales figures of plant species offered from the nurseries listed in the Plant Finder would need further investigation.

Without investigation of the sales figures of plant species offered with KWP from the nurseries listed in the Plant Finder it is not possible to determine the potential financial impact of KWP plants, and subsequently plant hunting, on the ornamental plant market. Neither is it possible to go on to understand the size of any potential monetary benefit to provider countries this area of the market could give in return for access to such KWP plants.

The literature review (Chapter 1) also found that KWP is discussed in the scientific literature as being of utmost importance to ex-situ conservation. If provenance is integral to the conservation and research value of living collections is there potential for plant hunting for commercial horticulture to be of conservation benefit? Can commercial horticulture provide conservation as a non-monetary benefit and to what extent?

The Global Strategy for Plant Conservation requires through Target 8 that at least 75 per cent of threatened plant species are brought into ex situ collections, preferably in the country of origin, and at least 20 per cent are made available for recovery and restoration programmes. With an estimated 27,148 plant species considered threatened with extinction (Lughadha et al. 2020) potential costs for ex-situ plant conservation could be great with one of the highest costs that of the introduction of species to collections (Griffith & Husby 2010). Ex-situ conservation is cited as one of the main reasons for the continued introduction of new species and genotypes of plants with KWP by commercial nurseries (Bruce 2018) but only in a small number of cases a threatened plant species' availability in commercial trade has been shown to have positively impacted plant conservation initiatives (e.g. Hitchcock & Rebelo 2018). Whilst there is lots of anecdotal evidence for commercial horticulture being able to offer conservation as a non-monetary benefit in return for access to wild plant material there is little robust/statistically tested data to support this claim.

Analysis of the Plant Finder data showed that 6.9% of species listed in the RHS Plant Finder have a GTS on BGCI's ThreatSearch and a significant proportion of the GTS species of horticulturally important genera, such as *Rhododendron*, *Magnolia* and *Sarracenia*, are available in commercial horticulture. As such it is feasible that commercial horticulture has the potential to assist in meeting conservation targets under the GSPC. However, in order for such plants to go on to provide a visible conservation benefit they must enable botanical institutions to meet globally recognised conservation targets such as the GSPC.

With over a quarter of the world's threatened oak species listed in the RHS Plant Finder in 2018 the potential for commercial horticulture to provide for ex-situ oak conservation in botanic gardens is shown. However, for these plants to go on to provide a conservation benefit they must find their way through to those institutions working to meet conservation targets under the GSPC. The results

from surveyed ex-situ oak collections showed that only 3 of the 76 accessions held within these collections had come from commercial horticulture, in turn showing that only a small proportion of plants are being accessed by these institutions and thus commercial horticulture can currently only be considered to be providing minimal conservation benefit for the genus *Quercus*. Analysis shows for the genus *Quercus* in ex-situ sites in UK's botanic gardens and arboreta there has been little direct impact from commercial horticulture on meeting the conservation targets that form the GSPC under the CBD despite suitable material being commercially available.

A large number of those genera analysed (*Rhododendron*, *Magnolia*, *Quercus*, *Sarracenia*) were found to have a high proportion of species with a GTS available commercially. Also, with a minimum of 4.2% of the world's plant species available commercially during 2018, commercial horticulture should not be overlooked as a source of plant material for ex-situ conservation. Additionally, with 10% of the non-threatened plant species available in commercial horticulture having KWP these could also provide for future conservation and restoration initiatives.

Horticulture has been shown to have the potential for the supply of plant species to botanic gardens and arboreta for ex-situ conservation and thus could provide conservation as a benefit. Given the high costs of the introduction of species to botanical collections from the wild the benefit of commercial horticulture supply to conservation also has the potential of easing financial pressure on plant conservation initiatives. The case of the Wollemi Pine (*Wollemia nobilis*) shows that commercialisation can bring both monetary and non-monetary benefits for plant conservation (Crane 2013). Yet the ability to purchase the plants legally has also brought with it the non-monetary benefit of removing the potential for an illegal trade in the species. Certainly, the case of the Wollemi pine is one where its conservation has benefited, both monetarily and non-monetarily, from the commercialisation of it as an ornamental plant and could be used as an example for future

commercialisation of plants that would lead to monetary benefits being returned to the origin country.

Whilst this preliminary study shows that commercial horticulture has the potential to be a viable resource for conservation and could assist botanic gardens and arboreta in meeting internationally agreed targets for plant conservation, more could be done to this end.



## Chapter 3: Consumer preferences for Known Wild Provenance plants in the horticultural trade

### 3.1 Introduction

Section 1.1 of the literature review (Chapter 1) confirms that all users of genetic resources, including commercial horticulture, were covered by the terms of the Nagoya protocol. Whilst plant breeding is the main area of horticulture that was considered by ABS legislation there are implications from this legislation that impact across the ornamental horticulture industry.

Whilst plant hunting seems to have reached its heyday in the late 18<sup>th</sup> and 19<sup>th</sup> Centuries the results from Chapter 2 show that the tradition of the plant hunter continues, with many nurseries still selling, and even specialising in, plants accessed as seed or living material directly sourced from their country of origin. Many of these 'plant hunting' nurseries publish detailed notes, descriptions or descriptive labels regarding the source of the plants and the expeditions made to collect them. The plants and seed collected in the wild by plant hunters is covered in many countries by restrictions on its commercialisation. For these plants to be sold with assurances that they are going to survive in consumers gardens many will require a period of research and development to understand aspects such as hardiness, invasiveness and ornamental appeal. Some will go on to be given cultivar names, become part of plant breeding projects and may even be given plant patents or registered trademarks. With such research and development being undertaken these plants fall within the parameters of the ABS legislation under the CBD.

This market in KWP plants alludes to an intangible value or credence attribute (Ford et al. 1988) associated with KWP plants. A requirement for conformity drives much of the horticulture industry and yet part of the market relies on plants that may not fit this model, those with KWP. These plants come with genetic variability and are collected from the wild, sold in small numbers by a limited

number of plant nurseries and grown by those that may be looking for something different or unique, rare and beautiful.

Some attributes attached to plants (i.e. hardiness, vigour, ability to grow in certain conditions etc) could be considered experience attributes (cannot be determined without actually purchasing) and others (i.e. cultivar name, specific flower colour, specific leaf shape etc) should be considered search attributes (features and characteristics easily evaluated before purchase). However, plants marketed with KWP are sold through a credence attribute (a quality that cannot be evaluated by the customer beyond the point of purchase) and this may lead to the perception that these plants are special and thus command a price premium.

The literature showed that within the UK ornamental horticulture sector, and particularly within the area of 'plant hunting', there is a lack of information regarding ABS and how the Nagoya Protocol may impact plant nursery businesses. There is a level of unease due to a lack of understanding as to how wild seed collectors can work within these rules. Little research or practical guidance has been conducted as to how commercial nurseries may provide benefits to the countries from which seed is accessed or the wider impacts this may have to international conventions such as the GSPC (Global Strategy for Plant Conservation – <https://www.cbd.int/gspc/>). Provider countries may also be unaware of the benefits that allowing access to genetic resources for commercial horticulture may bring.

A lack of market data regarding the credence of KWP and a call for increased use of wild plant material and genes in urban landscape planning (Cavender & Donnelly 2019) led to this experimental study where we asked the questions: Do the cases of the Wollemi pine and the trade in the wild

orchids (discussed in sections 1.2, 1.4 and 1.5) lead to the idea that there may be price premium for plants of KWP compared to plants from horticultural origin?

If plants of KWP are valued more highly than those of horticultural origin and consumers are prepared to pay more for these plants could this premium be translated, through ABS agreements with plant hunting nurseries, into monetary benefits for the countries providing access to plant material to use toward conservation?

These questions are integral to understanding how plant hunting for commercial horticulture can be compatible with ABS. To answer these questions an understanding of the potential price premium associated with KWP was required. In order to estimate this price premium a choice experiment (CE) was utilised.

A choice experiment is a stated preference method with its origins in economic consumer theory, which states that a preference is not for a product itself but for the characteristics that it possesses (Lancaster 1966). This theory, combined with random utility modelling (McFadden 1980), assumes that consumers will choose to buy the product with the characteristics that offer them the highest utility. Choice experiments enable researchers to measure a respondent's Willingness to Accept (WTA) compensation or Willingness to Pay (WTP) a premium for different characteristics of a product. After extensive use in the marketing and transport sectors, choice experiments have been adopted in other fields, such as agriculture (e.g. Birol et al. 2009), environmental planning (e.g. Hanley et al. 2003) and conservation (e.g. Veríssimo et al. 2009). They have also been used to study consumer preferences for mass-market orchids in Hawaii, a major producer and consumer of pot-plant orchids (Palma et al. 2010), and consumer preferences for orchids in international trade (Hinsley et al. 2015).

In this study, we use a choice experiment to assess consumers' preferences and WTP for KWP, with the aim of understanding if there is a price premium for plants of KWP compared to plants with a range of other attributes. Additional socio-economic analysis of this data is also used to understand whether respondents selected for KWP in either a homogenous or heterogenous manner and to what extent.

The main contribution to the literature from this research is that of providing data regarding the price premium (the WTP value) associated with KWP and other attributes associated with the sale of plants in the type of specialist nursery that sells KWP plants. Additionally, this value is then used to understand what monetary benefit could be offered in return for access to KWP plant material for commercial horticulture from provider countries for use for conservation purposes.

## 3.2 Methods

### 3.2.1 Choice experiment design: Overview

To undertake our analysis, we designed and implemented a survey instrument that contained a CE. As part of the preliminary work involved in designing the survey instrument, sales labels from nurseries (for a list see Appendix 2) known to sell KWP plant material were used to select a wide range of attributes which were then reduced in number by a focus group (for details see Appendix 3). The focus groups comprised 20 people, with the aim of selecting the appropriate set attributes for the choice experiment.

In addition to the CE, a range of other questions were developed for the main survey. Some of the questions preceded the CE so as to settle respondents into answering the survey as well as to capture socio-economic information used to provide greater potential understanding of the choice experiment data (for CE example see Appendix 3).

### 3.2.2 Main survey

In total the survey was composed of 22 questions covering a range of topics relating to respondent's plant purchases and their gardens. The survey also asked questions regarding the socio-economic status of the respondent. The survey was initially distributed in two stages via a number of plant societies to their membership and later via social media. Before distribution via social media a 23<sup>rd</sup> question was added asking if respondents had ever been a member of a plant or gardening club, group or society (see Appendix 4).

Page one of the surveys contained a range of both socio-economic and non-socio-economic questions about the respondent's garden and plant purchasing habits. It was intended that these questions would engage the respondent with the survey and encourage them to continue through to the next page rather than stopping due to the first questions being too difficult.

The core of the survey contained the plant choice instrument that asked respondents which plant they might choose based on information they may find on the plant label (Figure 3.1). A range of 6 attributes were selected for respondents to choose from; 4 based on information commonly found on nursery plant labels, plus two required attributes of KWP and price. The purpose of the plant choice experiment aspect of the consumer survey was to understand the correlation between KWP and the amount a consumer is prepared to pay for a plant. In order to achieve this a range of alternative attributes needed to be offered to survey respondents.



Figure 3.1. Summary table showing each attribute and the associated levels

Attribute question	Abbreviated attribute	Levels
Will it be ok outside in the winter in the UK?	HARDY	Yes(✓) / No(X)
Is it a named cultivar or variety?	NAMED CULTIVAR	Yes(✓) / No(X)
Is it rare in cultivation?	RARE IN CULTIVATION	Yes(✓) / No(X)
Is it rare in the wild?	RARE IN WILD	Yes(✓) / No(X)
Does it have known wild provenance (KWP)?	KWP	Yes(✓) / No(X)
Price (£); based on a plant in a 2 ltr pot or, when thinking about alpine plants, in a 9cm diameter pot	COST	£2, £4, £7, £10, £14, £20

To create the choice experiment, NGene (<http://www.choice-metrics.com/features.html>) was used to create 32 unique choice cards (Figure 3.2), each allowing the respondent to make a choice between 3 plant options or make the decision not to choose a plant based on whether the answer was yes or no to the range of questions and based on the price of the plant. To further simplify the options for respondents Yes answers were simplified to the ✓ symbol and No answers to the X symbol. Explanations for each of the attributes were given (see Appendix 3 ‘The features explained’).

Figure 3.2. Example choice set used in the study. Presented with the instruction: “Which of the plant choices shown would you buy based solely on the information provided”. ✓ = Yes X = No

Card 1	Plant 1	Plant 2	Plant 3
Price (£)	£ 4.00	£ 2.00	£ 20.00
Will it be ok outside in the winter in the UK?	✓	✗	✓
Is it a named cultivar or variety?	✓	✗	✓
Is it rare in cultivation?	✗	✗	✓
Is it rare in the wild?	✗	✓	✓
Does it have known wild provenance?	✗	✓	✗

The choice experiment aspect of the survey was followed by a range of further questions that would give insight into the socio-economic status of the respondents, such as their age, employment status, whether they were linked to horticulture professionally, their level of education, their gender identity and where they currently live.

In order to make the survey more accessible and engaging, it was split into 4 separate surveys each containing a unique subset of the choice experiment comprising 8 of the choice cards. The surveys were accessed via a webpage (URL: <http://www.blackhalls.co.uk/which-plant-would-you-buy-a-plant-choice-survey>) that asked potential respondents to click on the day of their birthday in order to randomise which one of the four surveys they took. The features shown on the choice cards were explained fully before the respondent was able to complete this section of the survey.

Finally, respondents had the opportunity to comment on the survey and provide additional information via an open comments box. All survey respondents were thanked for their participation



and were given the option to find out more about the research via a link.

### 3.2.3 Data collection

The survey was distributed via Survey Monkey (<https://www.surveymonkey.com/>) and was aimed at people that may shop for plants in specialist nurseries and may choose to buy species plants over horticultural varieties – i.e. plant enthusiasts. It was directed towards, but not exclusive to, UK consumers and was initially distributed to a range of plant societies via their social media feeds, newsletters and journals. It was also distributed via a range of specialist plant groups on Facebook and via Twitter. In total 14 national plant societies and clubs were contacted, the majority of these societies and clubs contacted were willing to disseminate the link to their members. 5 of the 14 societies contacted were not willing to involve their members in survey participation and provided no explanation for not doing so. Between 4<sup>th</sup> January and 13<sup>th</sup> September 2019, the surveys were made available only to these club members, however only a small number of respondents took part in the surveys. After the initial period was completed, an additional question was added to the survey and the survey was opened up to members of specialist plant groups and gardening enthusiasts on social media. The additional question ‘Have you ever been a member of a gardening or plant society, group or club (including online groups on social media)?’ was added with respondents being unable to continue to complete the survey unless they responded in the affirmative or negative to this question. After this point the survey remained open for a further 8 weeks, overall, the survey was accessible for respondents from the 1<sup>st</sup> April to the 2<sup>nd</sup> October 2019.

### 3.2.4 Statistical Analysis of a Choice Experiment

In a CE, respondents are presented with two or more choices for a given scenario that is described by differing levels of a set of attributes. Respondents are then asked to select their preferred choice for a group scenario from each group, and aggregate responses can be used to determine the relative value placed on each attribute (Veríssimo et al. 2009).

In order to analyse the data collected by CE developed in this research a multinomial logit regression model (MNL) and Latent Class Model (LCM) were used. The MNL is the basic ('work horse') model used to analyse CE data. However, to accommodate behavioural extensions it is typical for researchers to use more sophisticated models such as the LCM. The LCM approach was chosen to reflect the likely presence of heterogeneity amongst respondents' preferences (Birol et al. 2009). LCMs have been used relatively recently to successfully identify preference heterogeneity in various conservation focussed research projects (e.g. Birol et al. 2009, Hinsley et al. 2015, Veríssimo et al. 2009).

Our analysis began by specifying a basic MNL and then we examined alternative specifications for the LCM. Having created LCMs for various combinations of variables, selected from the socio-economic data collected as part of the survey, a final (preferred) model specification was identified. It was selected by testing across all variables, considering criteria such as standard error and utility function significance. This preferred specification includes the variables that best explain preferences and the number of latent classes (e.g. different types of consumers) across the survey respondents.

### 3.2.5 Econometric Specification

A utility function represents a consumer's preference ordering over a set of choices. In CEs the utility function will depend on the attributes (including cost) of each choice. When econometrically modelling CE data it is assumed that an individual's ( $n=1\dots N$ ) preferences are the sum of a systematic, observable component and a random component that can be formally represented as follows:

$$U_{ni} = V_{ni}(X_{ni}, \beta) + e_{ni} \quad (1)$$

where  $U_{ni}$  represents the utility gained from selecting alternative  $i$ ,  $V_{ni}$  is the systematic component of utility which is a function of the attributes ( $X_{ni}$ ) and a vector of the parameter coefficients that are estimated ( $\beta$ ), and  $e_{ni}$  the random error component (Birol et al. 2009).

The MNL model specification was used to undertake our initial analysis is shown in equation 2:

$$U_i = \beta_{1i} (\text{Hardy}) + \beta_{2i} (\text{Named Cultivar}) + \beta_{3i} (\text{Rare in Cultivation}) + \beta_{4i} (\text{Rare in the Wild}) + \beta_{5i} (\text{KWP}) + \beta_{6i} (\text{Cost}) + e_i \quad (2)$$

Based on equation (2), we estimated  $\beta_j(j=1,\dots,6)$  for all of the attributes employed in the CE. We employed the software NLOGIT (version 5.0, Econometric Software, Inc., New York, USA) to conduct the econometric analysis.

With results generated (i.e., the estimated coefficients) we were then able to calculate the WTP of respondents for each of the individual attributes.

WTP estimates is defined as the maximum price a customer is prepared to pay for the product with a specific attribute compared to without it. *For example, if there are two plants which are the same in every respect, except that one is labelled as having a particular attribute that the other lacks, then we can estimate how much more the customer would be prepared to pay for the plant with the additional attribute.*

To estimate WTP, we need to divide the attribute coefficient of interest by the coefficient for cost.

i.e.

$$WTP_1 = \beta_1/\beta_6 \tag{3}$$

$WTP_1$  yields a sample mean estimate for the WTP of attribute 1. In this case, if we assume that  $\beta_1$  is the attribute for “hardy” as shown in equation (2) then  $WTP_1$  is the estimate of the value attached to having a plant that is hardy compared to one that is not. In order to assess the statistical significance of the WTP estimates, we can undertake a Wald test. All of these calculations can be implemented in NLOGIT5.

As noted, our CE data and utility specification can also be analysed at a more granular level by using a LCM which classifies the respondents into different behavioural classes, estimating the coefficients

and WTP for each attribute by class. Additionally, class membership can be examined and explained by employing various socio-economic data.

### 3.3 Analysis

A total of 912 respondents took part in the online survey which ran for a period of 6 months. This yielded 7,296 completed choice sets. To understand what proportion of respondents could be considered plant enthusiasts, we asked respondents to answer the question *‘Have you ever been a member of a gardening or plant society, group or club (including online groups on social media)?’* – respondents directly relating to distribution by plant societies to their members were considered before they were able to go on and complete the survey. In addition, we asked all respondents about their gender and whether they were employed in horticulture professionally (Figure 3.3).

Figure 3.3. Socio-economic background of survey participants

Socio-economic parameter	Response		
What gender do you identify as?	Male – 41%	Female – 21%	Other or Prefer not to Say – 38%
Are you employed in horticulture	✓ – 26%	X – 40%	Other or Prefer not to Say – 34%
Have you ever been a member of a gardening or plant society, group or club (including online groups on social media)?	✓ – 67%*	X – 33%	N/A

\* including all respondents coming directly from the membership of plant societies during the earlier stages of the survey.

The results shown in Figure 3.3, indicate that the largest group of respondents by gender are Males with the next largest group either preferring not to answer the question or identifying as gender

'other'. Over two thirds of respondents responded positively to being, or having been, a member of a plant society, while only just over a quarter of respondents were employed in horticulture.

We next examine the results generated by our MNL specification. These results are shown in Figure 3.4. The first thing to note about the parameter estimates in Figure 3.4 is that plants labelled as HARDY, NAMED CULTIVAR, RARE IN CULTIVATION and KWP were more likely to be chosen than a plant not labelled as such. In all cases these attribute parameter estimates are statistically significant at the 1% level of significance. Also, we note that HARDY was the attribute with the highest utility and proved to be the most important attribute of those offered with KWP having only 17% of the utility of HARDY (percentage based on dividing the coefficient of HARDY by that of KWP).

As we can see from Figure 3.4 plants with the attribute RARE IN THE WILD were less likely to be chosen than plants not labelled as such. Indeed, this attribute yielded a negative parameter estimates implying that its inclusion on a label would have a detrimental impact. Therefore, of all the attributes employed in our CE, based on the results of the MNL, we can conclude that it is the least impactful attribute for survey respondents. Finally, as we anticipated, plants with higher prices were less likely to be chosen.

Figure 3.4. Model Attribute Coefficients with 95% Confidence Intervals

Attribute	Coeff	Lower 95% CI	Higher 95% CI	Standard Error	P Value
COST	-0.04***	-0.05	-0.02	<0.01	<0.01
HARDY	1.51***	1.35	1.67	0.08	<0.01
NAMED CULTIVAR	0.41***	0.25	0.57	0.08	<0.01
RARE IN CULTIVATION	0.28***	0.12	0.43	0.08	<0.01
RARE IN WILD	-0.13	-0.29	0.04	0.09	0.14
KWP	0.25***	0.09	0.41	0.08	<0.01

Note: Statistically significant at: \*\*\*1%, \*\*5% and \*10% level of significance

Turning to the WTP estimates for the attributes as shown in Figure 3.5 our MNL WTP estimates, derived assuming that all respondents were deemed a homogenous group, for each of the attributes are the sign we would expect given the results in Figure 3.4. HARDY has a WTP value of £39.53, NAMED CULTIVAR a WTP of £10.83, RARE IN CULTIVATION a WTP of £7.22 and KWP with a WTP value of £6.58. However, RARE IN THE WILD shows a negative WTP meaning that this attribute reduces the price a respondent from the sample is prepared to pay for a plant by £3.33.

The results reveal that based on a MNL model specification that Hardy is the most highly valued attribute being almost 4 times greater in magnitude. The other positively valued attributes are similar in magnitude. Thus, these results would suggest that plant survival is by far the most important attribute to the buying public. When treated as a homogenous group, respondents were willing to pay higher prices for all attributes to a greater or lesser extent except for RARE IN THE WILD and that KWP attracted a WTP value. However, our MNL results are somewhat limited. This is because the MNL treats the respondents as if they are homogenous, which is an unrealistic assumption. To determine if there was heterogeneity across our survey respondents and what any heterogeneity revealed we consider our LCM model estimates when reviewed with multiple classes.

Figure 3.5. Mean WTP in £ and WTA in -£ for all attributes in LCM respondents when treated as a homogenous group

Attributes	WTP (£)	Lower 95% CI	Higher 95% CI
Will it be ok outside in the winter in the UK? (HARDY)	39.53***	-52.94	-26.13
Is it a named cultivar or variety? (NAMED CULTIVAR)	10.83***	-12.97	-8.69
Is it rare in cultivation? RARE IN CULTIVATION)	7.22***	-9.24	-5.20
Is it rare in the wild? (RARE IN THE WILD)	-3.33	-2.34	9.01
Does it have known wild provenance (KWP)?	6.58***	-8.69	-4.47

Note: Statistically significant at: \*\*\*1%, \*\*5% and \*10% level of significance

A two class LCM was initially analysed. This LCM split the respondents into a group that valued all attributes and a group that only valued hardiness and cultivar status. The two class LCM did not provide an understanding of whether there was a subset of people that may value credence attributes such as rarity and wild provenance information over all others<sup>2</sup>. To understand if there was a third group of respondents that chose a different range of attributes a three class LCM was also estimated. The three class LCM gave a richer fit of the data and as such the selected specification we report here. The three class LCM results are reported in Figure 3.6.

<sup>2</sup> The econometric results for the 2 class LCM are provided in Appendix 5.



Figure 3.6. Coefficient and Standard Error (SE) for all attributes in the 3 class LCM

Attribute	Class 1		Class 2		Class 3	
	Coeff	SE	Coeff	SE	Coeff	SE
HARDY	0.79	0.16	2.58	0.21	1.80	0.19
NAMED CULTIVAR	0.96	0.16	-0.06	0.21	0.22	0.19
RARE IN CULTIVATION	1.04	0.16	-0.16	0.18	-0.34	0.20
RARE IN WILD	0.75	0.17	-0.72	0.20	-1.10	0.21
KWP	0.83	0.16	0.11	0.19	-0.57	0.20
COST	-0.07	0.02	-0.00	0.02	-0.08	0.02
NO CHOICE	-1.07	0.32	-0.62	0.34	0.83	0.31
Average Class Probabilities	0.310	31.0%	0.415	41.5%	0.275	27.5%

From Figure 3.7 we begin by examining Class 1. For Class 1, all attributes had a positive utility apart from COST and NO CHOICE, which had a negative utility showing that respondents in Class 1 considered not choosing a plant to be detrimental. All of the estimates are statistically significant.

For Class 2, respondents made choices that were not based on COST as this attribute is not statistically significant. However, they were more likely to strongly select for hardiness while selecting against rare in the wild. It is worth noting that not all of the estimates are statistically significant.

Finally, in Class 3 plants labelled as HARDY or NAMED CULTIVAR were more likely to be chosen than others. Plants labelled as HARDY were significantly, 8.42 times, more likely to be chosen than even those labelled as a NAMED CULTIVAR. All other attributes had a negative utility apart from NO CHOICE. This implies that, for Class 3 respondents, plants that were HARDY and a NAMED CULTIVAR were the only ones of interest.

Figure 3.7. WTP in sterling pounds for all attributes in the 3 class LCM

Class	Attribute	WTP	Lower (95% CI)	Higher (95% CI)
1	HARDY	£11.16***	-13.43	-8.90
	NAMED CULTIVAR	£13.62***	-16.47	-10.77
	RARE IN CULTIVATION	£14.87***	-16.47	-10.77
	RARE IN WILD	£10.78***	-12.88	-8.69
	KWP	£11.78***	-14.18	-9.38
2	HARDY	£46,078.60	-32,394,940.60	32,302,783.40
	NAMED CULTIVAR	-£1,047.00	-740,502.39	742,596.38
	RARE IN CULTIVATION	-£2,870.30	-2,018,078.07	2,023,818.66
	RARE IN WILD	-£13,207.40	-9,267,039.00	9,293,453.90
	KWP	£2,038.94	-1,427,758.43	1,423,680.55
3	HARDY	£25.41***	-34.93	-15.89
	NAMED CULTIVAR	£3.02	-6.98	0.94
	RARE IN CULTIVATION	-£5.33	-2.10	12.76
	RARE IN WILD	-£14.99**	2.98	27.00
	KWP	-£8.35*	-0.47	17.17

Note: Statistically significant at: \*\*\*1%, \*\*5% and \*10% level of significance

WTP values were calculated for each of the three classes and are presented in Figure 3.7. We can see that for Class 1, all attributes had positive WTP values with RARE IN CULTIVATION being valued most highly with a WTP of £14.87 and KWP having a WTP of £11.78. No attributes had a negative estimate in Class 1. Confidence intervals across Class 1 were similar for all attributes.

Turning to Class 2, all WTP estimates were substantially larger than those for either of the two other classes, due to the magnitude of the coefficient for COST being very small. HARDY had a WTP of £46,078.60 and KWP a WTP of £2,038.94 with all other attributes having large WTA values. Confidence intervals were exceptionally large for all attributes, indicating that these intervals are statistically insignificant. Class 2 shows the decision to select one plant versus another was driven by the need for the plant to be hardy above all other attributes and that the price for these plants was not considered of importance in selection.

Finally, Class 3, HARDY had a WTP of £25.41 and NAMED CULTIVAR had a WTP of £3.02 and all other attributes had a WTA value. KWP had a WTA value of £8.35. For Class 3, confidence varied across all attributes.

Figure 3.8. Coefficient and Standard Error (SE) for statistically significant socioeconomic parameters that describe classes in the 3 class LCM

Socioeconomic parameter	Class 1		Class 2		Class 3	
	Coeff	SE	Coeff	SE	Coeff	SE
GENMR	0.65**	0.28	0.22	0.27	0.00	0.00
PROF	1.04***	0.26	0.29	0.25	0.00	0.00
JOBEMP	0.55**	0.24	0.83***	0.23	0.00	0.00
LIVESWEN	0.62	0.45	0.76*	0.43	0.00	0.00
Average Class Probability	0.31	30.7%	0.41	41.3%	0.28	28.0%

Note: Statistically significant at: \*\*\*1%, \*\*5% and \*10% level of significance

Through a staged approach of selecting statistical significance at: \*\*\*1%, \*\*5% and \*10% for each of the socio-economic parameters, further analysis of the 3-class model was undertaken alongside the socio-economic data from the survey results (Figure 3.8). This incremental analysis showed that there was a high confidence that Class 1 respondents were Male, Employed, Professional horticulturists. It also showed that Class 2 respondents came from the south west of England and were employed. However, the analysis did not allow us to determine which socio-economic parameters best described Class 3 (Figure 3.8).

Figure 3.9. WTP in sterling pounds for all attributes in the 3 class LCM when analysed alongside statistically significant socioeconomic parameters

Class	Attribute	WTP with Socio economic analysis	Lower (95% CI)	Higher (95% CI)
1	HARDY	£11.65***	-14.23	-9.07
	NAMED CULTIVAR	£14.23***	-17.53	-10.94
	RARE IN CULTIVATION	£15.49***	-19.29	-11.69
	RARE IN WILD	£11.20***	-13.63	-8.78
	KWP	£12.34***	-15.17	-9.51
2	HARDY	£12.34	-271,963.33	263,614.19
	NAMED CULTIVAR	-£89.71	-6,267.06	6,446.47
	RARE IN CULTIVATION	-£279.38	-18,183.39	18,742.15
	RARE IN WILD	-£1,182.29	-75,395.82	77,760.39
	KWP	£160.73	-9,954.52	9,633.05
3	HARDY	£23.69***	-31.87	-15.51
	NAMED CULTIVAR	£2.92	-6.78	0.94
	RARE IN CULTIVATION	-£4.33	-2.28	10.93
	RARE IN WILD	-£14.18**	3.21	25.15
	KWP	-£7.24*	-0.64	15.11

Note: Statistically significant at: \*\*\*1%, \*\*5% and \*10% level of significance

Figure 3.10. Comparison of WTP in sterling pounds for all attributes in the 3 class LCM when analysed with and without statistically significant socioeconomic parameters

Class	Attribute	WTP with Socio economic analysis	WTP without socioeconomic analysis
1	HARDY	£11.65***	£11.16***
	NAMED CULTIVAR	£14.23***	£13.62***
	RARE IN CULTIVATION	£15.49***	£14.87***
	RARE IN WILD	£11.20***	£10.78***
	KWP	£12.34***	£11.78***
2	HARDY	£4,174.57	£46,078.60
	NAMED CULTIVAR	-£89.71	-£1,047.00
	RARE IN CULTIVATION	-£279.38	-£2,870.30
	RARE IN WILD	-£1,182.29	-£13,207.40
	KWP	£160.73	£2,038.94
3	HARDY	£23.69***	£25.41***
	NAMED CULTIVAR	£2.92	£3.02
	RARE IN CULTIVATION	-£4.33	-£5.33
	RARE IN WILD	-£14.18**	-£14.99**
	KWP	-£7.24*	-£8.35*

Note: Statistically significant at: \*\*\*1%, \*\*5% and \*10% level of significance

WTP values were also assessed during the analysis for statistically important socioeconomic parameters in the 3 class LCM (Figure 3.9 & 3.10). We found that whilst WTP values did not change significantly from the 3 class LCM analysis without socioeconomic parameters for Class 1 and Class 3 they reduced significantly for Class 2, although low confidence in class 2 was maintained (Figure 3.10). For Class 1 all WTP values increased showing that Male, Employed, Professional horticulturists values each attribute more highly, for Classes 2 and 3 a reduced WTP value was noted, there was a particularly marked change for values for Class 2.

For Class 1, all attributes still had positive WTP values with RARE IN CULTIVATION being valued most highly with a WTP of £15.49 and KWP having a WTP of £12.34. No attributes had a negative estimate in Class 1 when associated with socioeconomic parameters. Confidence intervals across Class 1 were similar for all attributes.

For Class 2, most WTP estimates were substantially larger than those for either of the two other classes. HARDY showed a WTP value of £12.34 and KWP a WTP of £160.73 with all other attributes having larger WTA values. Confidence intervals were exceptionally large for all attributes, indicating that these intervals are statistically insignificant. Class 2 shows the decision to select one plant versus another was driven by the need for the plant to have KWP above all other attributes and that the price for these plants was considered of less importance by members of this class.

Finally, Class 3, HARDY had a WTP of £23.69 and NAMED CULTIVAR had a WTP of £2.92, all other attributes had a WTA value. KWP had a WTA value of -£7.24. For Class 3, confidence varied across all attributes.

### 3.4 Discussion

The results of the CE have revealed interesting findings regarding the types of attributes that appear to determine purchase preferences on the part of plant buyers. Foremost of all, there is a very strong need to buy plants that are hardy. Of all of the attributes used in the survey hardiness is the one that best shows that a plant buyer will likely succeed in growing a plant in their garden. Whilst hardiness is an experience attribute that, when described via a plant label, can be easily corroborated with research and will be shown through success in cultivating the plant. Hardiness can be associated with other attributes such as Cultivar Name and KWP at some level; cultivars can be selected and marketed for their hardiness and wild provenance information can allude to hardiness. However, assurance of hardiness can only be given after a period of research and development over years of trial across multiple climatic parameters. For plants to be traded as hardy there are likely to be additional costs incurred during the research and development period and as such, whilst people have shown they are prepared to pay more for hardiness, the profit margin to producers is likely to be reduced. All of the other attributes employed in the CE appear to attract similar levels of interest in terms of the strength of preferences expressed. Rare in the Wild was overall the least appealing attribute and, in all cases, it accrued WTA values or the lowest WTP values.

KWP did not prove to be a strong driver of purchase for buyers although there is positive value attached by a segment (around 70%) of the buying population, a group that we showed can be best described as males, employed as professional horticulturists living in the South West of England. Whilst KWP, as a credence attribute, cannot be easily verified by plant buyers it does enable them to ascertain further a plants potential hardiness through research. Over 40% of respondents, those in Class 2 of the 3 class LCM, were willing to pay significantly over the stated price for KWP, this may also allude to further factors driving demand such as plants with KWP being deemed special in other ways. When taking the climate adaptation and provenance research of Watkins et al. (2019) into consideration, the link between hardiness and KWP becomes clear and as such when wild seed is



collected, given that it automatically has KWP (as long as that information is recorded and stored alongside the seed), hardiness can be inferred adding additional value. For this additional value to be realised however information storage and sharing becomes paramount and so KWP promotes the economic value of keeping good records. It is only when plants with KWP enter the supply chain that the associated value inferred from provenance data becomes an explicit value and, of course, that relies on KWP information being used in marketing material.

Trade in around 30,000 plant species is controlled by The Convention on the International Trade in Endangered Species (CITES). For many plant species (Orchidaceae, Cactaceae, some carnivorous plant species, *Cyclamen* etc) on CITES Appendix I and II to be traded internationally, artificial propagation is required to be proven. CITES requires that artificially propagated specimens are still subject to its provisions and this includes regulations to ensure the operation of plant nurseries is not detrimental to wild plant conservation (CITES 2020b). Nurseries supplying plants with KWP require a continuous flow of wild sourced seed or plants to maintain the explicit value associated with that wild provenance yet with sustainability in mind CITES demands that only propagated offspring two generations removed from this wild-sourced parental stock may be sold (CITES 2020a). Nurseries selling CITES listed plants propagated in this way from plants with KWP can register with CITES authorities to demonstrate their adherence with the rules. However, registration, permitting and the specific requirements of transportation of CITES plants internationally adds an additional level of expense (CITES 2020b), thus further reducing the value attached to CITES listed KWP plants. Amongst other expenses associated with KWP plants collection costs, permit costs, phytosanitary and quarantine restrictions should also be considered in the production framework, further reducing the profit accrued by nurseries wishing to trade in KWP plants.

With the majority (70%) of survey respondents in this study prepared to pay more for KWP plants, an ability for commercial horticulture to provide monetary benefit for access to plants of wild

provenance is shown. The monetary benefits from the commercialisation, research and development for ornamental horticulture of wild collected plant material, however, are limited to 70% of plant buyers with higher value monetary benefits further limited to a much smaller proportion of those buyers (40%). Additionally, increased cost associated with sourcing and supply of these plants will further impact the potential for profit and subsequent monetary benefits. The implication of the findings from this study for policy makers keen on using KWP information to better inform purchase choice is that, whilst a proportion of plant purchases may be driven by wild provenance information, ABS negotiations should not be based solely on monetary benefits from the sale of plants.

Plants with genetic variability, collected from the wild, sold in small numbers by a limited number of plant nurseries may not bring the financial gains looked to by policy makers unless sold alongside experience attributes such as hardiness, marketed with cultivar names or numbers available for sale are limited. As a result, they remain rare in cultivation and subsequently command higher prices from those plant enthusiasts (Class 2) that are prepared to pay higher sums.

With KWP becoming a feature in calls for genetic and species diversity in urban trees (Stevenson et al. 2020) in line with increasing amounts of research looking at how plants can be better adapted to future predicted climates (Pounders et al. 2004, Gross et al. 2017, Watkins et al. 2019), demand for KWP plants may grow. Internationally calls for both botanic gardens and nurseries to step up to the challenges imposed by climate predictions means that increased access to a wider range of intra specific plant material of known provenance will be required. In accessing this material, it will be increasingly important that both donors and recipients of genetic material for commercial horticulture are aware of the monetary implications of ABS agreements.

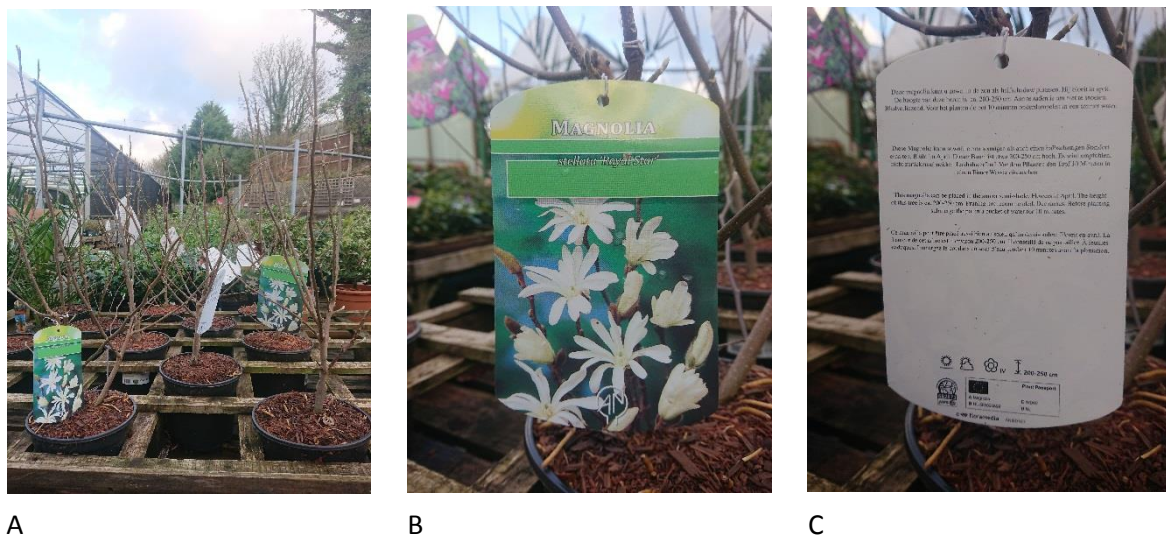
## Chapter 4: Case study: The Star Magnolia (*Magnolia stellata*) - an endangered species from Nagoya, Japan.

Drawing on the findings of the previous two chapters here a case study is offered to assist in understanding in the potential application of this research and analysis. Through the case study it is shown how a species of plant originally accessed from the wild, introduced to mainstream cultivation and then used for commercial development and plant breeding for commercial horticulture could go on to provide both monetary and non-monetary benefits to conservation both ex-situ and within its country of origin, the provider of the original genetic material. This case study for the threatened species *Magnolia stellata* is offered as a means of showing how mutually beneficial agreements between provider countries and commercial horticulture could be achieved.

The genus *Magnolia* has 319 species worldwide, nearly half of which (147 or 46.1%) have a global threat status. *Magnolia* is a horticulturally important genus and one globally threatened species is of particular note. *M. stellata* (Siebold & Zucc.) Maxim. is Endangered in its wild state (IUCN Red List status: Endangered B1ab (iii, v)) due to a small area of occurrence and continuing decline in mature individuals and quality of habitat (Harvey-Brown 2019). It is endemic to Japan where it is restricted to a narrow area in Central Honshu around Nagoya, limited to hilly areas below 600 m above sea level. The area, often called the Tokai Floristic Region is characterised by the occurrence of many local endemic or semi-endemic species such as *Acer pycnanthum*. The potential forest distribution of the *M. stellata* is 1,854 km<sup>2</sup> and the extent of occurrence (EOO) is estimated to be c. 3,000 km<sup>2</sup> (Harvey-Brown 2019). The species is threatened due to urban development and each of its populations are small and fragmented. Each of these sub populations is both phenotypically and genetically unique and it has been recommended that conservation measures should prioritise this (Ueno et al. 2008).

*M. stellata* was introduced to British cultivation from Japan in about 1877 by Charles Maries, who collected it on behalf of Veitch Nurseries (Veitch 1906). It has gone on to become a horticulturally important tree species with 34 different cultivars listed as available in the Plant Finder in 2018 and over 70 cultivars registered as selections or hybrids with the Magnolia Society International (Lobdell 2020). At any one time there may be 150,000 *M. stellata* (Spencer, Plants for Europe Ltd, pers. com. 2016b) in production in the Dutch horticultural trade alone. *M. stellata* has been used extensively in breeding and hybridisation with one hybrid between this species and *M. kobus*, *M. × loebneri*, forming the cultivar 'Leonard Messel' - one of the most acclaimed Magnolia cultivars and holder of an RHS Award of Garden Merit. None of the registered cultivars, however, have been sourced directly from KWP material (Lobdell 2020) despite it being commercial practice for nurseries that engaged in 'plant hunting' to assign cultivar names to individual selections from wild seed collections.

Figure 4.1. a) *M. stellata* for sale in a) UK garden centre b) Front of sales label for *M. stellata* c) Back of sales label for *M. stellata*



Given the importance of the species to commercial horticulture and the level of this international trade, could sales of KWP *M. stellata* generate both monetary and non-monetary benefits for its conservation?

Through a model incorporating lessons from the commercialisation of the Wollemi pine, the conservation work for *Erica verticillata* and the use of cultivars in *Castanea* spp. conservation it is feasible that KWP cultivars of *M. stellata* could be marketed alongside information regarding the conservation work being undertaken for the species (example label shown in Figures 4.3 & 4.4). With a WTP value for KWP when survey respondents were considered a homogenous group of around £6.58 per individual plant there is potential for significant conservation income to be raised by commercial horticulture in return for access to wild genetic resources. Such access to wild plant material would also enable distinct wild clones (shown as the cultivar name 'Hazamacho' (Figure 4.3 & 4.4) of *M. stellata* to be used for plant breeding and selection of future cultivars that may be more suited to predicted future climates (Watkins 2019, Watkins et al. 2019).

Based on a Google search for '3 litre ltr *Magnolia stellata* for sale' (undertaken 10<sup>th</sup> November 2020) where only 10 exact matches were found across the first 3 pages of 5,680 results, the average price for a *Magnolia stellata* was found to be £21.39; the cheapest plants being sold at £16.99 each for both unnamed plants and named cultivars and the most expensive at around £34.99 each for named cultivars. Given this, there is the potential for KWP cultivars of *M. stellata* to be sold for values in the region of between £22.59 and £41.59 (shown £39.99 in Figure 4.4). There is potential for up to 70% of plant enthusiasts to be interested in the purchase of these plants of *M. stellata*. Should the KWP plants be shown to be more suited to current and predicted climates (RHS Hardiness rating: H6 in Figure 4.4) the proportion of people that may be more interested in the purchase of these plants and the WTP of the plants would increase further. At least part of this increased monetary value could be used toward both the in situ and ex-situ conservation of the species. Based on the example of 10% of a *M. stellata* sales being of KWP and allowing for an upper rate of 50% of a WTP value of £6.58 per plant sold benefiting conservation projects then a value of £49,350 could be raised for

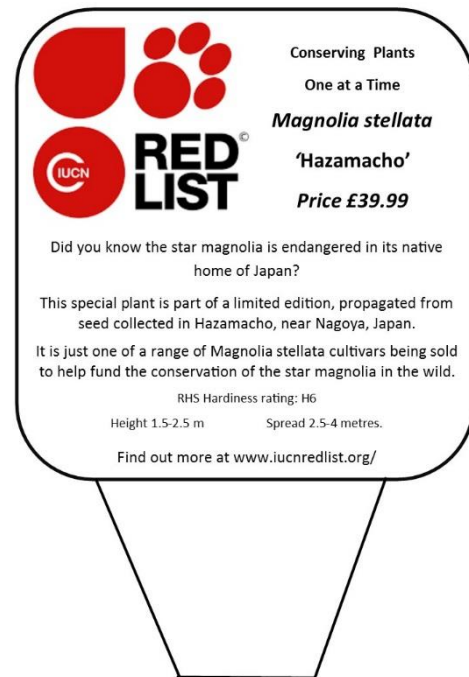
conservation projects per every 150,000 plants from Dutch cultivation alone. However, possibly more realistically, based on other examples of benefit sharing agreements (Chapter 1, Section 1.1), with between 1.5% and 6% of the value of each plant being directed to benefit sharing agreements (between £0.34 and £2.49 per plant) again based on the example that 10% of *M. stellata* sales could be from KWP plants, a sum of between £5,100 and £37,452 could be raised for conservation per 150,000 *M. stellata* plants sold.

The conservation value of these plants could also be considered significant. The ability to accurately trace plants sold alongside their KWP (through registration of a cultivar name) to individual plants, populations or localities (shown through the cultivar name and KWP information in Figure 4.4) would allow for genetic material from across the range of the species to be grown in private, public and botanic gardens. Such a scheme would allow the costs involved in collection and distribution of plant material to be absorbed into the retail price of the plants. Such a scheme could allow for significant amounts of genetic material to be cultivated ex-situ enabling cultivation of large sections of the genetic diversity found in the wild populations. There are a number of factors that would impact the sale of such plants. A period of research and development would be required in order to assess suitability for garden cultivation (e.g. hardiness assessment), as well as mass propagation in order to meet demand. This is in addition to an ability to market to the right group of plant buyers to maximise sales.

Figure 4.2. Example label front



Figure 4.3. Example label back



## Chapter 5: Conclusion

The aim of this MSc by Research was to address the question: **'Plant hunting for commercial horticulture and access and benefit sharing: complementary or competitive uses of wild novel plants?'** Specifically, the thesis set out to investigate the extent to which KWP plant material, and thus the tradition of the plant hunter, is still relevant to ornamental commercial horticulture and how it can be married with, and work within, the impacts of legislation enshrined in the Convention on Biological Diversity regarding access and benefit sharing.

This was attempted through a review of the relevant literature associated with the practical application of ABS within commercial horticulture (Chapter 1), A preliminary study into the prevalence in commercial horticulture of wild provenance plants and their potential benefit to plant conservation (Chapter 2) and a statistical analysis of consumer preferences for known wild provenance plants in the horticultural trade (Chapter 3).

The literature review was undertaken so as to understand if there was already sufficient research to answer the question. As the review of available literature shows there is evidence from media articles both online and in print that suggests that plant hunting for commercial horticulture is still relevant. However, much of this grey literature comes directly from the area of the industry interested in the promotion of the practice of Plant Hunting; the nurseries and consumers of plants sourced in this way. There is little peer reviewed research available relevant to the thesis question. There is also no evidence of commercial horticulture businesses that partake in plant hunting actively engaging in ABS agreements and very few cases where the wider commercial horticulture sector has engaged in ABS agreements.

Recent calls (Stevenson et al. 2020) have expressed a need for ornamental plants that are more suited genetically to our urban environments and for the purpose of conservation and scientific



research. Plant hunting for commercial horticulture has the ability to source those plants but in order to do so terms of access and subsequent sharing of benefits would need to be agreed. For plants sourced from the wild to be utilised most effectively a period of research and development is required to understand the hardiness, invasiveness and garden worthiness. Those plants considered most suitable would then go on to be marketed with cultivar names or plant breeder's rights and as such ABS agreements would need to be entered into.

The review allowed for the identification of a number of areas that were not yet covered in the literature and, through the identification of these gaps, raised the following supplementary questions.

1. The literature reviewed in section 1.3 shows that KWP plants are of importance and relevance to commercial ornamental horticulture, but to what extent is the industry reliant upon them?
2. Do the cases of the Wollemi pine and the trade in the wild orchids (discussed in sections 1.2, 1.4 and 1.5) lead to the idea that there may be price premium for plants of KWP compared to plants from horticultural origin?
3. If plants of KWP are valued more highly than those of horticultural origin and consumers are prepared to pay more for these plants could this premium be translated into monetary benefits for the countries providing access to plant material to use toward conservation?
4. Can the availability of KWP plants in ornamental commercial horticulture assist in meeting the obligations of internationally agreed ex-situ conservation targets?

5. If so, can conservation be considered as a potential non-monetary benefit to provider countries in return for access to KWP plant material for commercialisation?

Reliance of the industry on KWP (Q1) plants was analysed through data from the Royal Horticultural Society's Plant Finder, and through assessment of choice experiment responses, the extent of the industries reliance on the type of KWP material accessed by plant hunters is evaluated. It was found that Plant hunting remains a source of novel plant species and varieties with nurseries still offering KWP plants. The list of species available for British gardens, most introduced to commercial trade by 'plant hunters', is extensive. The RHS annual publication 'The Plant Finder' listed "more than 70,000 plants" (including varieties and cultivars) during 2018 and of this 16,300 were species. In the region of one in 10 (or 10.5%) of the 16,300 species listed as available in the RHS Plant Finder have KWP.

This figure may be even larger as the analysis did not consider plants now sold under a cultivar name that may originally have been sourced from the wild where the wild provenance is now unknown or requires investigation. With 1,704 collector's codes associated with individual plant species, some being sold under multiple collector's codes, available in UK commercial horticulture during 2018 it is demonstrable that the trade is still reliant on the introduction of such plants. The availability of KWP plants in the Plant Finder did not, however, reflect demand. 70% of choice experiment respondents were prepared to pay more for KWP and over 40% were prepared to pay significantly more for KWP. Whilst this amounts to an indication of the market for KWP plant material it does not give a full understanding of the reliance of commercial horticulture on KWP plants and their market share.

The CE went on to answer supplementary question (Q2) of whether there is a price premium for plants of KWP compared to plants from horticultural origin and (Q3) whether this premium could be translated into monetary benefits for the countries providing access to plant material for conservation use?

The results of the CE revealed purchase preferences on the part of plant buyers with hardiness being foremost. Whilst hardiness can be evaluated through research in a range of climatic parameters it is only through a consumer's experiences in their own garden that it can be shown to be true for an individual's circumstances. Hardiness is an experience attribute that is marketed through labelling and can be associated with other attributes such as Cultivar Name and KWP. Plants that are traded as hardy had the highest WTP values, yet to be traded as hardy there are likely to be research and development costs involved for producers. KWP did not prove to be a strong driver of purchase for buyers although there was positive value attached by a segment (around 70%) of CE respondents. KWP cannot be easily verified by plant buyers yet it does allude to a plants suitability for a given climate and thus alludes to hardiness which may also be a driver of purchase of KWP plants. This link between KWP and hardiness will subsequently add value to plants with KWP but that will only ever be realised should that KWP be communicated.

A group of CE respondents (over 40%) were willing to pay even higher prices for KWP, leading to an idea that there are further factors driving demand such as plants with KWP being valued for their '*uniqueness, rarity and beauty*' (Mackenzie & Yates 2016, p.341) or the inference of the belief that collectors of KWP plants '*view themselves as connoisseurs, heroes, public servants, saviours, tourists and harbingers of class*' (Mackenzie & Yates 2016, p.346) in a similar way to collectors of antiques.

This study showed that, due to the WTP value put on KWP plants by survey respondents, there is an ability for commercial horticulture to provide monetary benefit for access to plants of wild provenance, yet a number of factors may limit the size of the benefits. The majority of plant enthusiasts are interested in purchasing KWP plants yet less than half are prepared to pay significantly more for the attribute and the sale of the plant to this area of the market relies on effective communication and marketing of the attribute. Increased cost associated with sourcing,

research and development, and supply of these plants will further impact the potential for profit and subsequent monetary benefits.

It is only when plants with KWP are marketed alongside other attributes that the monetary value of KWP can be fully maximised. Plants sold alongside their KWP in the majority of cases will demand a higher price, yet two scenarios allow for this value to be augmented.

- Plants sold in limited numbers, so they remain rare in cultivation, marketed to (and subsequently demand higher prices from) those plant enthusiasts that are prepared to pay significantly more for KWP, as was the case for the first lots of Wollemi pine made available by auction at Sotheby's.
- Plants are sold alongside experience attributes such as hardiness, marketed with cultivar names or large numbers are made available for sale with a small additional value added to allow for benefit sharing.

Plants grown from seed that are genetically distinct, collected from the wild, sold in small numbers by a limited number of plant nurseries may not bring the financial gains looked to by policy makers. The implication of the findings from this study for policy makers keen on using KWP information to better inform purchase choice is that, whilst a proportion of plant purchases may be driven by wild provenance information, ABS negotiations should not be based solely on monetary benefits from the sale of plants.

Conservation is cited by those involved in commercial horticulture as one of the main reasons for the continued introduction of new species and genotypes of plants with KWP (Bruce 2018).

Supplementary questions 4 and 5 asked about the relevance of the availability for sale of such plants

was of benefit to conservation initiatives. Yet the literature review only found a small number of cases where threatened plant species' availability in commercial trade was shown to have positively impacted plant conservation initiatives (e.g. Hitchcock & Rebelo 2018). Whilst there is anecdotal evidence for commercial horticulture being able to offer conservation as a non-monetary benefit in return for access to wild plant material there is little data to support this claim.

Analysis found that the non-monetary benefit of conservation should be considered in ABS agreements. With an estimated 27,148 plant species considered threatened with extinction, and estimates at 37% of the world's plants at similar risk of extinction (Lughadha et al. 2020), potential costs for ex-situ plant conservation could be great with one of the highest costs that of the introduction of species to collections (Griffith & Husby 2010). Commercial horticulture was shown to have the potential to provide conservation through allowing access to KWP plants. The financial burdens to botanic gardens and arboreta of accessing plants could be reduced, with that burden being absorbed into commercial overheads or increased prices for KWP plants made available commercially.

6.9% of species listed in the RHS Plant Finder have a GTS and a significant proportion of the GTS species of horticulturally important genera were available for sale. In order for these plants to go on to provide a visible conservation benefit and enabling botanical institutions to meet globally recognised conservation targets such as the GSPC they must be made available legally. For the genus *Quercus* little evidence was found of a supply chain of threatened oak trees from commercial horticulture to ex-situ conservation, and subsequent performance towards targets. Allowing access through ABS agreements would enable institutions engaged in meeting conservation targets to go to commercial horticulture to source plants in some cases.

With a large percentage of GTS availability in horticulturally important genera such as *Rhododendron*, *Magnolia*, *Quercus* and *Sarracenia* and with 4.2% of the world's plant species available commercially during 2018 commercial horticulture should not be overlooked as a source of plant material for ex-situ conservation and restoration initiatives. Additionally, a significant proportion of the non-threatened plant species available in commercial horticulture have KWP and could provide a reserve for the benefit to future conservation and restoration initiatives.

Whilst the numbers discussed seem small, for a country, the UK, that represents 3.2% of the global gross domestic product (URL: <https://www.pwc.com/gx/en/research-insights/economy/global-economy-watch/projections.html> accessed 2020), only 0.87% of the global population and just 0.2% of the global land area (URL: <https://www.worldometers.info/> accessed 2020) to have 4% of the world's plant species available for sale creates a level of context.

Comparing these numbers to the holdings of the world's botanic gardens is also a valuable way of contextualising these figures. 105,634 species (around 30%) of plants are held in Botanic Gardens globally (Mounce et al. 2017) compared to 4.17% of global plant species available in the RHS Plant Finder in 2018. 13,218 threatened plant species held in at least one ex situ collection globally (Mounce et al. 2017) yet 1118, 8.46%, of that number, were available for sale in nurseries listing them as available in the UK through the RHS Plant Finder.

Commercialisation has been shown, through this research, to be able to bring both monetary and non-monetary benefits for plant conservation. The ability to purchase plants with KWP legally could also bring with it the additional non-monetary benefit of removing the potential for an illegal trade in plant species (shown through the case of the Wollemi pine). Nurseries supplying plants with KWP

either require a continuous flow of wild sourced plant material or initial access to material from which further plants can be propagated in order to maintain the explicit value associated with wild provenance. International conventions such as CITES allow for the propagation of listed plants under specific rules, yet this relies upon legal access to the required propagation stock or sustainable quotas specified in ABS agreements.

The case of the Wollemi pine (Crane 2013) is one where its conservation has benefited, both monetarily and non-monetarily, from the commercialisation of it as an ornamental plant and should be used as an example for future commercialisation of plants that would lead to monetary benefits being returned to the origin country.

With KWP becoming a feature in calls for genetic and species diversity in urban trees (Stevenson et al. 2020) in line with increasing research looking at how plants can be better adapted to future predicted climates (e.g. Gross et al. 2017, Pounders et al. 2004, Watkins et al. 2019) demand for KWP plants is likely to grow. Internationally, calls for both botanic gardens and nurseries to step up to the challenges imposed by climate predictions means that increased access to a wider range of intraspecific plant material of known provenance will be required. In accessing this material, it will be increasingly important that both donors and recipients of genetic material for commercial horticulture are aware of the monetary and non-monetary implications to enable ABS agreements. It is important that both monetary benefits and non-monetary benefits are considered in ABS agreements for commercial horticulture. Whilst there are few cases where ABS agreements have been used in commercial horticulture there is potential for positive outcomes for both providers and users of plant genetic diversity when commercial horticulture is considered.

In answer to the key research question, this study has found preliminary evidence that plant hunting for commercial horticulture and ABS should be considered complementary rather than competitive. It will, however, take effort on the side of both those in a position to allow access and those in a position to provide benefits for this compatibility to be fully achieved.

## 5.1 Further investigation

There are a number of points in this research that warrant further investigation in the future and limit the scope of the conclusions that can be drawn from the results of this thesis. Further research should be undertaken considering plants now sold under a cultivar name that may originally have been sourced from the wild where the wild provenance requires investigation. Should this level of analysis be undertaken it would almost certainly find that a higher proportion of taxa available in commercial horticulture are of KWP.

A more in-depth study should be undertaken to gain an understanding of supply routes of plants to botanic gardens and arboreta and to understand more fully their ability to access plant material from commercial horticulture. The question ‘Why don’t botanic gardens in the UK look to commercial horticulture to broaden the wealth of plant species held among their collections?’ is raised. Similar analysis to that undertaken for *Quercus* should be conducted over a much wider range of genera to give a deeper understanding of the potential impacts of commercial horticulture for the ex-situ conservation of individual genera.

Two of the genera analysed as part of the range of commonly grown horticultural plant groups, *Sarracenia* and *Aloe*, are genera covered by either Appendix I or II of CITES and may be less likely to



be legally imported from the wild or sold alongside their wild provenance information. It would be worthwhile undertaking additional analysis to understand if other CITES genera (e.g. *Galanthus*, *Cyclamen*, *Cyathea*) were also available with associated KWP information.

With many in commercial horticulture claiming conservation as an outcome of continued plant hunting a stronger understanding is required of the range of conservation projects that commercial horticulture in the UK has been, and is already, involved in. Such projects may not have a direct impact on targets under the GSPC or may meet a range of alternative targets under global agreements. This could be achieved through direct questioning and informal interviews within the industry itself.

Over 40% of CE respondents were willing to pay significantly over the stated price for KWP and so more in-depth analysis into further factors driving demand for plants with KWP should be undertaken. Additionally, it would be worthwhile rerunning the CE with higher values associated with plant choices in order to better understand the additional WTP value for this group. Further, in order to obtain a better understanding of the reliance of commercial horticulture on KWP plants and their market share, sales figures of plant species offered from the nurseries listed in the Plant Finder would need investigation and this could also be achieved through surveying nurseries known to sell material of KWP .

## 5.2 Recommendations

Whilst this preliminary study shows that commercial horticulture has the potential to be a viable resource for conservation and could assist botanic gardens and arboreta in meeting internationally agreed plant conservation targets more could be done to this end. For the conservation value of

those plants available in commercial horticulture to be met, botanic gardens, arboreta and those involved in the ex-situ conservation and restoration of plants should be enabled to start looking on commercial horticulture as a resource of KWP plant material. For this to happen controlled and legal access to wild plant material for commercialisation should be catered for in the relevant legislation of provider countries. Allowing legal access to plant material for commercialisation should be considered.

This study has shown that there is increased monetary value associated with plants of KWP and that their sale does have the ability to provide a monetary benefit to provider countries for the purpose of in-situ conservation. It is with this in mind that the recommendation is made that commercial horticulture and provider countries use the preliminary results of this investigation to engage in discussions that will enable benefit sharing agreements to be formed.

Should these recommendations be implemented the relationship between both those accessing and those providing access to KWP plants for commercial ornamental horticulture could be strengthened. The outcome of such a strengthening of this relationship could see both parties benefit both monetarily in the form of increased profit and non-monetarily in the form of reduced illegal trade and ex-situ plant conservation.

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## Technical Appendix:

# ‘Plant hunting for commercial horticulture and access and benefit sharing: complimentary or competitive uses of wild novel plants?’

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## 1 List of *Quercus* species available for sale in Plant Finder during 2018

*Quercus acerifolia* (E.J.Palmer) Stoyhoff & W.J.Hess ex R.J.Jensen

*Quercus acherdophylla* Trel.

*Quercus acutifolia* Née

*Quercus affinis* Scheidw.

*Quercus alnifolia* Poech

*Quercus arkansana* Sarg.

*Quercus austrina* Small

*Quercus benthamii* A.DC.

*Quercus buckleyi* Nixon & Dorr

*Quercus candicans* Née

*Quercus crispipilis* Trel.

*Quercus dumosa* Nutt.

*Quercus georgiana* M.A.Curtis

*Quercus germana* Schltld. & Cham.

*Quercus glabrescens* Benth.

*Quercus graciliformis* C.H.Müll.

*Quercus havardii* Rydb.

*Quercus hintoniorum* Nixon & C.H.Müll.

*Quercus hirtifolia* M.L.Vázquez, S.Valencia & Nixon

*Quercus insignis* M.Martens & Galeotti

*Quercus miquihuanensis* Nixon & C.H.Müll.

*Quercus oglethorpensis* W.H.Duncan

*Quercus pacifica* Nixon & C.H.Müll.

*Quercus polymorpha* Schltld. & Cham.

*Quercus pontica* K.Koch

*Quercus rysophylla* Weath.

*Quercus sartorii* Liebm.

*Quercus tomentella* Engelm.

*Quercus xalapensis* Bonpl.

## 2 Quercus ex-situ survey example

Quercus ex-situ survey

1. Do you grow any of the following *Quercus* species and, if so, from where were they sourced?

	A Botanical garden or institution	A private collection	A commercial nursery	seed or plant from the wild	Don't know	Not in the collection
<i>Quercus acerifolia</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>Quercus acherdophylla</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>Quercus acutifolia</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>Quercus affinis</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>Quercus alnifolia</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>Quercus arkansana</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>Quercus austrina</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>Quercus benthamii</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>Quercus buckleyi</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>Quercus candicans</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>Quercus crispipilis</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>Quercus dumosa</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>Quercus georgiana</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>Quercus germana</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>Quercus glabrescens</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>Quercus graciliformis</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>Quercus havardii</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>Quercus hintoniorum</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>Quercus hirtifolia</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>Quercus insignis</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>Quercus miquihuanensis</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>Quercus oglethorpensis</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>Quercus pacifica</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>Quercus polymorpha</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>Quercus pontica</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>Quercus rysophylla</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>Quercus sartorii</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>Quercus tomentella</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>Quercus xalapensis</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>


Device View

Survey Format

Other (please specify)

2. In which country is your garden located?

DONE

Powered by  
 SurveyMonkey  
See how easy it is to [create a survey](#).

### 3 Label examples

Yellow highlighted text shows types of Known Wild Provenance information

#### Example 1

*Sarmentia repens*

Choice, partially epiphytic evergreen for acid to neutral, bark rich soil. Beautiful pendant, red lantern flowers over a long period. Prostrate, warm, sheltered peat bed, alpine house or conservatory in shade.

Price: £4.00

#### Example 2

*Asarum infrapurpureum* - BSWJ1694

Description:

A low evergreen perennial species with creeping elongated rhizomatous roots. Bearing 2-3 leaves per stem, which are heart shaped decoratively white to pale green marked on their upper surfaces, purple below, somewhat reminiscent of *Cyclamen* foliage. The brownish flowers are three lobed borne near the ground with wrinkled centres. From one of our collections gathered from the dark damp forest of Taipingshan, a mountainous area in northern Taiwan in November 1993 at around 1885m. Best grown in a fully to partly shaded site, in a moisture retentive acidic to neutral soil which is drained.

Pot Size: 9cm

Price: £10.00

#### Example 3

*Agapanthus inapertus* 'Lydenburg'

Good mid-blue, very drooping flowers with flared mouths in large heads on stout 1.2m stems. Arose at Kirstenbosch and thought to be a hybrid of two wild forms of *inapertus*. For a sunny position in good soil.

No price listed

#### Example 4

Begonia sp. **U614**

**Introduced from Arunachal Pradesh** and distributed incorrectly as *B. sikkimensis* by Michael Wickenden, this highly attractive probable new species has wonderfully deeply lobed and lacerated foliage in shades of silvery grey and green, with a deep red underside and white flowers. Reasonably hardy outside with a winter mulch, though superb in a pot too.

No price listed

#### Example 5

*Carpinus omeiensis* **KR0280**

This is a small, hardy tree with elegant, weeping branchlets. The dainty, slender, veined leaves are bright bronze-red when emerging, washed bronze later. **Collected on Mt. Omei, China.**

Price: £28.00

#### Example 6

*Correa reflexa* **'Brisbane ranges'**

This small, evergreen shrub is one of the most stunning *Correas*, with brilliant fire-engine red bells which are gold tipped. A stunner but difficult to propagate. Hardiness unknown. Australian mountains.

Price: £16.50

#### Example 7

*Illicium yunnanensis*

A hardy, vigorous, upright evergreen which will grow to a large shrub or small tree. The new growth of the aromatic leaves is dark bronze-red. Early yellow flowers in spring are heavily scented. Loves shade or sun. In short supply. China.

Price: £22.00

#### Example 8

*Achlys triphylla*

North American Woodland perennial with leaves having three shallow lobes, on slender stems, arising from scaly, creeping rhizomes. Flowers white in spikes just above the foliage. April – June. For moist leafy soil in part shade.

Price: £6.00

#### Example 9

*Euptelia pleiosperma*

(syn. *franchetii*) - a rare tree or large shrub with attractive copper-tinted new growth and excellent autumn colour. Leaves have jagged teeth

Available Early Spring 2021 - Should be available March/April onwards depending on growing conditions.

£20.00 each

Example 10

Agastache rugosa 'Korean Zest' - BSWJ735

Pot Size: 1.5 litre

Price: £7.00

Description:

A clumping aromatic transient perennial with upright bristly stems, forming a drift of ovate toothed leaves which emerge with a purple tinge, bearing erect spikes of purple/blue flowers, June to Sept. Full sun-part shade well drained soil, associating well with gravelled areas where it can self-seed. Our 1993 collection from South Korea.

Pot Size: 1.5 litre

Price: £7.00

#### 4 Attribute selection

A range of attributes was selected from plant labels from specialist nurseries and offered alongside the question 'What do you look for when you are buying plant from a nursery? From the list of features below, please rank the FIVE most important features or information when selecting a plant. (Please select your FIVE most important features ranking them in order of importance to you)' was posed with a range of 15 answer options given on a matrix scale of most important to least important. The attributes were chosen from a range of those commonly found on plant labels in independent nurseries and descriptions of plants online.

A total of 15 potential attributes were selected from those regularly used to describe plants to customers on the websites of 4 specialist nurseries. All four nurseries sell a wide range of plant species across all sectors of the industry including alpine plants, succulents, rhododendrons, woody shrubs and trees, grasses and herbaceous perennials. Two of the nurseries actively 'plant hunt' and two do not.

The Scottish Rock Garden Club forum (<http://www.srgc.net/forum/>) was chosen as a way of engaging a focus group with the mini survey as the membership of the Scottish Rock Garden Club covers a wide range of interests in horticulture. Additional responses were gained from the authors Facebook page. A total of 19 responses were gathered with respondents taking an average of 3 minutes to complete the mini survey (Fig 1).

1. What do you look for when you are buying plant from a nursery? From the list of features below, please rank the FIVE most important features or information when selecting a plant. (Please select your FIVE most important features ranking them in order of importance to you)

	Least important	Low importance	Medium importance	High importance	Most important
Cultivar name	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Family	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Rarity in trade	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Country of origin	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Price	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Conservation status	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Provenance information	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Flower colour	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Variety	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hardiness for my region	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Royal Horticultural Society Award of Garden Merit	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Care information provided	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Growing medium	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ethically sourced	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Collector information	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Answer Choices	Least important	Low importance	Medium importance	High importance	Most important	Total	Weighted Average
Cultivar name	2	0	1	1	3	7	3.43
Family	0	1	1	0	1	3	3.33
Rarity in trade	0	3	1	2	2	8	3.38
Country of origin	0	0	0	1	0	1	4
Price	3	4	2	1	0	10	2.1
Conservation status	0	0	1	1	0	2	3.5
Provenance information	1	3	1	0	0	5	2
Flower colour	2	0	1	0	2	5	3
Variety	1	0	0	1	3	5	4
Hardiness for my region	0	0	3	2	6	11	4.27
Royal Horticultural Society Award of Garden Merit	2	2	0	1	0	5	2
Care information provided	1	1	2	0	0	4	2.25
Growing medium	1	1	2	1	0	5	2.6
Ethically sourced	3	1	2	1	0	7	2.14
Collector information	1	1	0	4	0	6	3.17
						Answer ed	19
						Skipped	0

- Which features, or information, not listed above also influence your decisions when buying a plant? Would they rank in your top 5 and, if so, what ranking would you award them?

Figure 1:

From the weighted averages of the responses to the mini survey it was possible to choose 4 attributes that would sit alongside price and KWP on the choice cards.

Whilst all 15 attributes were chosen as survey responses 6 were clearly more important to respondents.



The 5 most looked for attributes were

**Hardiness for my region** with a weighted average of 4.27

**Country of origin** with a weighted average of 4

**Conservation status** with a weighted average of 3.5

**Cultivar name** with a weighted average of 3.43

**Rarity in trade** with a weighted average of 3.38

'Hardiness' ranked as the most important attribute with a weighted average (WA) of 4.27, 'Country of origin' and 'variety' ranked equally with a WA of 4 and 'conservation status', 'cultivar name' and 'rarity in trade' ranking almost equally with WAs of 3.5, 3.43 and 3.38 respectively. Collectors information had a WA of 3.17 which was close to the WAs of all the least important attributes and so was not chosen to be one of the final attributes used although this was considered to be equivalent to KWP. Country of origin and collector information were amalgamated to create just one of the two fixed attributes: KWP.

As the relevance of wild provenance and price are integral to the study these two attributes were added to the 6 top ranking attributes from the focus work and variety and cultivar name were amalgamated to create one attribute creating a total of 7 attributes.

- **Hardiness for my region**
- **Conservation status**
- **Cultivar name**
- **Rarity in trade**

Alongside the two fixed attributes

- **Price**
- **KWP**

To make the choice experiment more engaging these attributes were changed to a series of questions, with 'Price' given as a range of selectable monetary values in pounds sterling.

1. **Price (£) - £2, £4, £7, £10, £14 and £20**
2. **Will it be ok outside in the winter in the UK?**
3. **Is it a named cultivar or variety?**
4. **Is it rare in cultivation?**
5. **Is it rare in the wild?**

Each of the final 6 attributes were assigned a range of values that would form the options in the choice experiments. The initial range of values assigned to each attribute consisted of specific terms (shown in Fig xx)

Attribute	value 1	value 2	value 3	value 4	
Hardiness for my region	Hardy to -14	Hardy to -6	Hardy to -2	not frost hardy	
Geographical origin	Asia	North America	Europe	South America	
Variety/Cultivar name	No cultivar/variety name	Named variety/CV	Cultivar with PVR		
Rarity in cultivation	Rarely offered for sale	Commonly offered for sale			
Rarity in wild	Rare in the wild	Common in the wild			
Provenance information	Yes	no			
Price	£5 - £10	£10 - £20	£20- £50	£50 - £100	£100+

Figure 22:

However, through a stepped process of simplification a final range of attributes and values were chosen that reduced the choice burden on the survey participant. Each of the attribute values was reduced to a yes/no answer apart from price, leaving a final attribute value range shown in fig xx

Attribute	value 1	value 2	value 3	Value 4	Value 5	Value 6
Will it be ok outside in the winter in the UK?	yes	no				
Is it a named cultivar or variety?	yes	no				
Is it rare in cultivation?	yes	no				
Is it rare in the wild?	yes	no				
Does it have Known Wild Provenance?	yes	no				
Price	£2	£4	£7	£10	£14	£20

## 5 Attribute descriptions

### 1) COST

Price (£)

The price is based on a plant in a 2 ltr pot or, when thinking about alpine plants, in a 9cm diameter pot

### 2) HARDY

Will it be ok outside in the winter in the UK?

Ok outside in the winter means that it would be undamaged by frost and does not need special care during the winter such as wrapping or moving to frost free conditions.

For example, the label may read

‘Hardy to -10°C or lower’

Needs frost protection over winter’

‘Not suitable for outdoor cultivation year-round’

‘Only hardy in the mildest areas of the UK’

### 3) NAMED CULTIVAR

Is it a named cultivar or variety?

A cultivar is a plant variety that has been produced in cultivation by selective breeding, a variety (var.) can often be found growing and reproducing naturally in the wild. Plants grown from its seeds will often come out true to type

The label may give more than just its botanical name

Rosa rugosa 'Scabrosa'  
Dahlia 'Bishop of Llandaff'  
Forsythia x intermedia 'Lynwood'  
Phyllostachys nigra var. henonis

#### 4) RARE IN CULTIVATION

Is it rare in cultivation?

Rare in cultivation means that it's rarely offered for sale or only available from a very small number of specialist growers and only ever available in limited numbers.

The label may read

'rarely offered for sale'

'limited availability'

'the first time we are able to introduce this species, limited numbers available'

#### 5) RARE IN WILD

Is it rare in the wild?

Rare in the wild means it may have an IUCN (International Union for the Conservation of Nature) conservation status of vulnerable, endangered or critically endangered.

The label may state

'threatened in its natural habitat'

'a rare species where it is found in the wild'

'Endangered in the wild by....'

#### 6) KNOWN WILD PROVENANCE

Does it have known wild provenance (KWP)?

KWP may come in the form of a collection locality, collectors code and accession number or other documented evidence that it had been, or is a 1st generation direct descendant of, a plant collected in the wild.

The label may say something like

'RBM1901'

'Tibetan form'

'Originally found on a small hillside in Yunnan'

'Collected just south of Antofagasta, Chile.'

## 6 Survey instrument example

Welcome

Thank you for participating in the survey, your answers will be used as part of the Masters by Research 'Plant hunting for commercial horticulture and access and benefit sharing: are they compatible?' This research is being undertaken by Robert Blackhall-Miles.

Find out more about this research [here](#)

The survey contains a total of 23 questions

Page 1 asks you about your garden and plant purchases

Page 2 asks you which plants you might choose based on information you may find on the plant label (this is a very important aspect of the survey so please persevere).

Page 3 asks some information about you that will help us to put your survey responses into some context (no personal information is asked for and there is a 'prefer not to say' option for each question).

All questions marked with \* require an answer before you can move on to the next page.

OK

Top of Form

\*1. By taking part in the survey you consent that your answers will be used as part of the Masters by Research 'Plant hunting for commercial horticulture and access and benefit sharing: are they compatible?'

I agree

NEXT

Bottom of Form

Page 1 - Your garden and plant purchases

Top of Form

\*2. Have you ever been a member of a gardening or plant society, group or club (including online groups on social media)?

- Yes
- No

\*3. How often do you buy new plants?

- More than once a week
- Once a week
- Once a month
- Every other month
- A couple of times a year
- Prefer not to say

\*4. What is the average amount that you would regularly spend on a plant?

- £2 - £5
- £6 - £10
- £11 - £15
- £16 - £20
- £20 - £100
- Over £100
- Prefer not to say

\*5. How much is the most that you would regularly be willing to spend on a plant?

- Up to £10
- Up to £20
- Up to £50

- Up to £100
- Over £100
- Prefer not to say

\*6. Where would you normally buy plants for your garden?

- A nursery that produces plants propagated from seeds collected in the wild
- a nursery that produces all its own plants
- a nursery that produces some of its own plants
- a nursery that sells plants that have been produced elsewhere
- a garden center
- a d.I.Y. store
- Prefer not to say

\*7. How big is your garden?

- no garden
- a small garden
- a medium garden
- a large garden
- between 1 and 5 acres
- over 5 acres
- Prefer not to say

8. What was the last plant that you bought?

Prev Next

## Page 2 - Plant choice comparison

What information on a plant label would you look for that would persuade you to buy one plant over any others? (this is a very important aspect of the survey so please persevere).

Each question shows 3 plant choices in a comparison table, for each question please choose just 1 plant (or choose 'None' if you would not buy any of the plant choices) from the options below each table.

✓ = Yes

X = No

Please ignore the card numbers as they have no relevance other than to help future analysis.

Please take some time to read the explanations of each of the features.

The features explained

### 1) Price (£)

The price is based on a plant in a 2 ltr pot or, when thinking about alpine plants, in a 9cm diameter pot

### 2) Will it be ok outside in the winter in the UK?

Ok outside in the winter means that it would be undamaged by frost and does not need special care during the winter such as wrapping or moving to frost free conditions.

For example, the label may read

'Hardy to -10°C or lower'

'Needs frost protection over winter'

'Not suitable for outdoor cultivation year-round'

'Only hardy in the mildest areas of the UK'

### 3) Is it a named cultivar or variety?

A cultivar is a plant variety that has been produced in cultivation by selective breeding, a variety (var.) can often be found growing and reproducing naturally in the wild. Plants grown from its seeds will often come out true to type

The label may give more than just its botanical name

Rosa rugosa 'Scabrosa'

Dahlia 'Bishop of Llandaff'

Forsythia x intermedia 'Lynwood'

Phyllostachys nigra var. henonis

#### 4) Is it rare in cultivation?

Rare in cultivation means that it's rarely offered for sale or only available from a very small number of specialist growers and only ever available in limited numbers.

The label may read

'rarely offered for sale'

'limited availability'

'the first time we are able to introduce this species, limited numbers available'

#### 5) Is it rare in the wild?

Rare in the wild means it may have an IUCN (International Union for the Conservation of Nature) conservation status of vulnerable, endangered or critically endangered.

The label may state

'threatened in its natural habitat'

'a rare species where it is found in the wild'

'Endangered in the wild by....'

#### 6) Does it have known wild provenance (KWP)?

KWP may come in the form of a collection locality, collectors code and accession number or other documented evidence that it had been, or is a 1st generation direct descendant of, a plant collected in the wild.

The label may say something like

'RBM1901'

'Tibetan form'

'Originally found on a small hillside in Yunnan'

'Collected just south of Antofagasta, Chile.'

Top of Form



\*9. Card 1, Which of the plant choices shown would you buy based solely on the information provided?

Card 1	Plant 1	Plant 2	Plant 3
Price (£)	£ 4.00	£ 2.00	£ 20.00
Will it be ok outside in the winter in the UK?	✓	✗	✓
Is it a named cultivar or variety?	✓	✗	✓
Is it rare in cultivation?	✗	✗	✓
Is it rare in the wild?	✗	✓	✓
Does it have known wild provenance?	✗	✓	✗

- Plant 1
- Plant 2
- Plant 3
- None

\*10. Card 2, Which of the plant choices shown would you buy based solely on the information provided?

Card 2	Plant 1	Plant 2	Plant 3
Price (£)	£ 7.00	£ 10.00	£ 10.00
Will it be ok outside in the winter in the UK?	✓	✗	✗
Is it a named cultivar or variety?	✗	✓	✓
Is it rare in cultivation?	✗	✗	✓
Is it rare in the wild?	✗	✓	✗
Does it have known wild provenance?	✓	✗	✗

- Plant 1
- Plant 2

- Plant 3
- None

\*11. Card 3, Which of the plant choices shown would you buy based solely on the information provided?

Card 3	Plant 1	Plant 2	Plant 3
Price (£)	£ 2.00	£ 7.00	£ 20.00
Will it be ok outside in the winter in the UK?	✗	✓	✗
Is it a named cultivar or variety?	✗	✓	✓
Is it rare in cultivation?	✓	✗	✓
Is it rare in the wild?	✓	✗	✓
Does it have known wild provenance?	✗	✓	✓

- Plant 1
- Plant 2
- Plant 3
- None

\*12. Card 4, Which of the plant choices shown would you buy based solely on the information provided?

Card 4	Plant 1	Plant 2	Plant 3
Price (£)	£ 4.00	£ 10.00	£ 14.00
Will it be ok outside in the winter in the UK?	✓	✗	✗
Is it a named cultivar or variety?	✗	✓	✓
Is it rare in cultivation?	✗	✓	✓
Is it rare in the wild?	✓	✓	✗
Does it have known wild provenance?	✗	✗	✓

- Plant 1
- Plant 2
- Plant 3
- None

\*13. Card 5, Which of the plant choices shown would you buy based solely on the information provided?

Card 5	Plant 1	Plant 2	Plant 3
Price (£)	£ 14.00	£ 10.00	£ 2.00
Will it be ok outside in the winter in the UK?	✓	✗	✓
Is it a named cultivar or variety?	✗	✓	✗
Is it rare in cultivation?	✗	✗	✓
Is it rare in the wild?	✓	✓	✗
Does it have known wild provenance?	✓	✓	✗

- Plant 1
- Plant 2

- Plant 3
- None

\*14. Card 6, Which of the plant choices shown would you buy based solely on the information provided?

Card 6	Plant 1	Plant 2	Plant 3
Price (£)	£ 14.00	£ 7.00	£ 7.00
Will it be ok outside in the winter in the UK?	✓	✗	✗
Is it a named cultivar or variety?	✗	✓	✗
Is it rare in cultivation?	✓	✗	✗
Is it rare in the wild?	✗	✓	✓
Does it have known wild provenance?	✓	✗	✓

- Plant 1
- Plant 2
- Plant 3
- None

\*15. Card 7, Which of the plant choices shown would you buy based solely on the information provided?

Card 7	Plant 1	Plant 2	Plant 3
Price (£)	£ 7.00	£ 7.00	£ 14.00
Will it be ok outside in the winter in the UK?	✗	✗	✓
Is it a named cultivar or variety?	✗	✓	✓
Is it rare in cultivation?	✗	✗	✓
Is it rare in the wild?	✓	✓	✗
Does it have known wild provenance?	✓	✗	✗

- Plant 1
- Plant 2
- Plant 3
- None

\*16. Card 8, Which of the plant choices shown would you buy based solely on the information provided?

Card 8	Plant 1	Plant 2	Plant 3
Price (£)	£ 2.00	£ 4.00	£ 20.00
Will it be ok outside in the winter in the UK?	✗	✓	✓
Is it a named cultivar or variety?	✗	✗	✓
Is it rare in cultivation?	✓	✗	✗
Is it rare in the wild?	✗	✓	✓
Does it have known wild provenance?	✓	✗	✓

- Plant 1
- Plant 2
- Plant 3
- None

Prev Next

### Page 3 - About you

You can help me understand a little bit more about you by answering the following questions. Should you not wish to answer one or more of these questions then just use the 'Prefer not to say' option or just skip the question.

#### Top of Form

17. what age are you?

- 18-24
- 25-34
- 35-44
- 45-54
- 55-64
- 65+
- Prefer not to say

18. Where do you currently live?

- North East (England)
- North West (England)
- East Midlands (England)
- West Midlands (England)
- East of England
- London
- South East (England)
- South West (England)
- North Wales
- South Wales
- Northern Ireland

- Scotland
- Prefer not to say
- Other (please specify)

19. To which gender identity do you most identify?

- Ms.
- Mr.
- Mx.
- Prefer not to say
- Not listed

20. What is your highest level of education that you have achieved?

- School education to 16
- A-level or equivalent
- Further education qualification
- Undergraduate degree
- Post-graduate degree
- Higher
- Prefer not to say

21. Are you employed in a profession linked to plants/horticulture?

- Yes
- No
- Prefer not to say

22. What is your employment status?

- Unemployed
- self employed
- employed
- retired
- other
- Prefer not to say

23. If you have any comments regarding the survey or additional information regarding the subject of the survey please use the comments box below.

Prev Thank-you for taking the time to complete the survey. [Click here to submit your answers.](#)

## 7 Basic Multinomial Logistic Regression (MLN).

### 7.1 Model Attribute Coefficients with 95% Confidence Intervals

#### 7.1.1 Code used and output

```

O-----O
| NLOGIT 5 (tm) Oct 05, 2020, 01:41:09PM |
| Econometric Software, Inc. Copyright 1986-2012 |
| Plainview, New York 11803 |
| Registered to Robert Blackhall-Miles |
| The University of Kent |
| Registration Number 0612-R215542-5NS |
O-----O
-----Initializing NLOGIT Version 5 (May 1, 2012)-----
-----
|-> NLOGIT;
    Lhs = choice, cset, alti;
    Choices = a, b, c, d;
    Model:
    U(a)= csta*ATTB_A + cspb*ATTB_B + cstc*ATTB_C + cstd*ATTB_D +
cste*ATTB_E + cstf*cost/
    U(b)= csta*ATTB_A + cspb*ATTB_B + cstc*ATTB_C + cstd*ATTB_D +
cste*ATTB_E + cstf*cost/
    U(c)= csta*ATTB_A + cspb*ATTB_B + cstc*ATTB_C + cstd*ATTB_D +
cste*ATTB_E + cstf*cost/
    U(d)= ascd;
    Pds = 8;
    checkdata$

```

Discrete choice (multinomial logit) model



```

Dependent variable          Choice
Log likelihood function     -6169.59788
Estimation based on N =    5168, K =    7
Inf.Cr.AIC = 12353.2 AIC/N =    2.390
Model estimated: Dec 10, 2019, 14:51:20
R2=1-LogL/LogL* Log-L fncn R-sqrd R2Adj
Constants only must be computed directly
                Use NLOGIT ;...;RHS=ONE$
Response data are given as ind. choices
Number of obs.= 5168, skipped    0 obs

```

```

-----+-----
--
--

```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
CSTA	1.50800***	.08136	18.53	.0000	1.34853	1.66747
CSTB	.41312***	.08194	5.04	.0000	.25252	.57371
CSTC	.27535***	.07945	3.47	.0005	.11963	.43107
CSTD	-.12704	.08524	-1.49	.1361	-.29410	.04002
CSTE	.25096***	.08053	3.12	.0018	.09312	.40881
CSTF	-.03814***	.00830	-4.59	.0000	-.05442	-.02187
ASCD	.36529***	.12958	2.82	.0048	.11132	.61925

```

-----+-----
--

```

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

## 7.2 MLN Coefficient table

Attribute	Coeff	Lower CI	Higer CI	Lower err	Upper err	Standard error	Probability
HARDY	1.51	1.35	1.67	0.16	0.16	0.08	0.00
NAMED CULTIVAR	0.41	0.25	0.57	0.16	0.16	0.08	0.00
RARE IN CULTIVATION	0.28	0.12	0.43	0.16	0.16	0.08	0.00
RARE IN WILD	-0.13	-0.29	0.04	0.17	0.17	0.09	0.14
KWP	0.25	0.09	0.41	0.16	0.16	0.08	0.00

7.2.1.1 5 Model Attribute Coefficients with 95% Confidence Intervals

## 7.3 Willingness to Pay (WTP)

### 7.3.1 Code and Output

```

|-> NLOGIT;
  Lhs      =          choice,      cset,      alti;
  Choices  =          a,          b,          c,          d;
  Model:
  U(a)=  csta*ATTB_A+          cstb*ATTB_B          +
         cstc*ATTB_C          +          cstd*ATTB_D          +
         cste*ATTB_E          +          cstf*cost/
  U(b)=  csta*ATTB_A          +          cstb*ATTB_B          +
         cstc*ATTB_C          +          cstd*ATTB_D          +
         cste*ATTB_E          +          cstf*cost/
  U(c)=  csta*ATTB_A          +          cstb*ATTB_B          +
         cstc*ATTB_C          +          cstd*ATTB_D          +
         cste*ATTB_E          +          cstf*cost/
  U(d)=  ascd;

```

```

parameters;
wtp      =          csta/cstf, cstb/cstf, cstc/cstf, cstd/cstf,
           cste/cstf;
Pds      =          8$
Normal exit:  5 iterations. Status=0, F=      6169.598

```

```

-----
--
Discrete choice (multinomial logit) model
Dependent variable      Choice
Log likelihood function  -6169.59788
Estimation based on N =  5168, K =   7
Inf.Cr.AIC = 12353.2 AIC/N =   2.390
Model estimated: Dec 27, 2019, 16:58:30
R2=1-LogL/LogL* Log-L fncn R-sqrd R2Adj
Constants only must be computed directly
           Use NLOGIT ;...;RHS=ONE$
Response data are given as ind. choices
Number of obs.=  5168, skipped   0 obs
-----

```

```

--

```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
CSTA	1.50800***	.08136	18.53	.0000	1.34853	1.66747
CSTB	.41312***	.08194	5.04	.0000	.25252	.57371
CSTC	.27535***	.07945	3.47	.0005	.11963	.43107
CSTD	-.12704	.08524	-1.49	.1361	-.29410	.04002
CSTE	.25096***	.08053	3.12	.0018	.09312	.40881
CSTF	-.03814***	.00830	-4.59	.0000	-.05442	-.02187
ASCD	.36529***	.12958	2.82	.0048	.11132	.61925

```

-----

```

```

--
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
-----

```

```

|-> Wald;

Pts=1000;
Labels =      b1,      b2,      b3,      b4,      b5,
           b6,      a1;
Start  =      b;
Var    =      varb;
Fn1    =      b1/b6;
Fn2    =      b2/b6;
Fn3    =      b3/b6;
Fn4    =      b4/b6;
Fn5    =      b5/b6$

```

```

-----
WALD procedure. Estimates and standard errors
for nonlinear functions and joint test of
nonlinear restrictions.
Wald Statistic          =      198.07782
Prob. from Chi-squared[ 5] =      .00000
Functions are computed at means of variables
-----

```

```

--

```

WaldFcns	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
----------	-------------	----------------	---	--------------	-------------------------	--

```

-----+-----
--
Fncn (1) | -39.5349***    6.83704    -5.78    .0000    -52.9353    -26.1346
Fncn (2) | -10.8306***    1.09152    -9.92    .0000    -12.9699    -8.6912
Fncn (3) | -7.21882***    1.02877    -7.02    .0000    -9.23518    -5.20247
Fncn (4) |  3.33052       2.89559     1.15    .2501    -2.34474     9.00579
Fncn (5) | -6.57946***    1.07666    -6.11    .0000    -8.68969    -4.46924
-----+-----

```

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

When treating respondents as a homogenous group WTP values for each of the attributes were shown as HARDY with a WTP value of £39.53, NAMED CULTIVAR with a WTP of £10.83, RARE IN CULTIVATION with a WTP of £7.22 and KWP with a WTP value of £6.58

However, RARE IN THE WILD shows a negative WTP meaning that this attribute reduces the price a respondent from the sample is prepared to pay for a plant by £3.33.

Price (£)	COST - £2, £4, £7, £10, £14, £20	WTP (£)
Will it be ok outside in the winter in the UK?	HARDY	39.53
Is it a named cultivar or variety?	NAMED CULTIVAR	10.83
Is it rare in cultivation?	RARE IN CULTIVATION	7.22
Is it rare in the wild?	RARE IN WILD	-3.33
Does it have known wild provenance (KWP)?	KWP	6.58

Table 6: WTP (Willingness to Pay) in £ for all attributes

#### 7.4 WTP 95% Confidence Interval Comparison of DELTA v. Krinsky & Robb

When running the WALD command without stating which method to use, NLOGIT will automatically run the code using the DELTA method. The 95% confidence intervals using this method, shown in the above graph, show that the confidence interval for HARDY is significantly larger than any of the other attributes. The lower CI being £26.13 and the upper end CI being £52.94. This is interesting given that the options given for COST were £2, £4, £7, £10, £14, £20, which are all lower than this range. This result tallies with responses to the question 'How much is the most that you would regularly be willing to spend on a plant?' 37.5% of respondents answered that they would be happy to spend over £20 on a plant.

**This could signify that higher COST options should be tried in future.**

Krinsky and Robb (K & R) is an alternative to the DELTA method and gives marginally different confidence intervals for WTP even though the coefficients themselves remain the same. An estimate of WTP including 95% confidence intervals was undertaken using the K & R method, as follows:

##### 7.4.1 Code and Output

```

|-> Wald;
    K&R;
    Pts=1000;
    Labels =      b1,      b2,      b3,      b4,      b5,
               b6,      a1;
    Start  =      b;

```

This text tells the WALD command to use the Krinsky and Robb method

```

Var      =      varb;
Fn1      =      b1/b6;
Fn2      =      b2/b6;
Fn3      =      b3/b6;
Fn4      =      b4/b6;
Fn5      =      b5/b6$

```

-----  
--  
WALD procedure. Estimates and standard errors  
for nonlinear functions and joint test of  
nonlinear restrictions.

```

Wald Statistic      =      171.55449
Prob. from Chi-squared[ 5] =      .00000
Krinsky-Robb method used with 1000 draws
Functions are computed at means of variables
-----+-----

```

```

--
      |           Standard      Prob.      95% Confidence
WaldFcns| Coefficient      Error      z      |z|>Z*      Interval
-----+-----
--
Fncn(1)| -39.5349***      8.36116      -4.73      .0000      -55.9225      -23.1474
Fncn(2)| -10.8306***      1.24153      -8.72      .0000      -13.2639      -8.3972
Fncn(3)| -7.21882***      1.13687      -6.35      .0000      -9.44706      -4.99059
Fncn(4)| 3.33052          3.53044      .94      .3455      -3.58902      10.25007
Fncn(5)| -6.57946***      1.14966      -5.72      .0000      -8.83276      -4.32617
-----+-----

```

-----  
--  
Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.  
-----  
--

#### 7.4.2 K & R Vs Delta comparison table

Attribute	WaldFcns	Lower CI (DELTA)	Higer CI (DELTA)	Standard Err (DELTA)	Lower CI (K&R)	Higer CI (K&R)	Standard Err (K&R)
HARDY	Fncn(1)	-52.9353	-26.1346	6.83704	-55.9225	-23.1474	8.36116
NAMED CULTIVAR	Fncn(2)	-12.9699	-8.6912	1.09152	-13.2639	-8.3972	1.24153
RARE IN CULTIVATION	Fncn(3)	-9.23518	-5.20247	1.02877	-9.44706	-4.99059	1.13687
RARE IN WILD	Fncn(4)	-2.34474	9.00579	2.89559	-3.58902	10.25007	3.53044
KWP	Fncn(5)	-8.68969	-4.46924	1.07666	-8.83276	-4.32617	1.14966

Overall, both K and R and the DELTA method agree on WTP coefficient estimates, but the delta method has narrower confidence intervals and a lower standard error. It was decided to use DELTA for this investigation.

## 8 2 Class Latent Class Model

### 8.1 Two Class Attribute Coefficients with 95% Confidence Intervals

#### 8.1.1 Code and Output

```

|-> NLOGIT;
    lhs = choice, cset, alti;
    Choices = a, b, c, d;
    Model:
    U(a)= csta*ATTB_A + cstb*ATTB_B + cstc*ATTB_C + cstd*ATTB_D +
cste*ATTB_E + cstf*cost/
    U(b)= csta*ATTB_A + cstb*ATTB_B + cstc*ATTB_C + cstd*ATTB_D +
cste*ATTB_E + cstf*cost/
    U(c)= csta*ATTB_A + cstb*ATTB_B + cstc*ATTB_C + cstd*ATTB_D +
cste*ATTB_E + cstf*cost/
    U(d)= ascd;
    LCM;
    pts = 2;
    pds=8$

```

The additional text 'LCM;' and 'pts = 2;' will split the data into two classes.

Normal exit: 5 iterations. Status=0, F= 6169.598

```

-----
--
Discrete choice (multinomial logit) model
Dependent variable      Choice
Log likelihood function -6169.59788
Estimation based on N = 5168, K = 7
Inf.Cr.AIC = 12353.2 AIC/N = 2.390
Model estimated: Dec 21, 2019, 17:23:09
R2=1-LogL/LogL* Log-L fncn R-sqrd R2Adj
Constants only must be computed directly
      Use NLOGIT ;...;RHS=ONE$
Response data are given as ind. choices
Number of obs.= 5168, skipped 0 obs
-----

```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
CSTA 1	1.50800***	.08136	18.53	.0000	1.34853	1.66747
CSTB 1	.41312***	.08194	5.04	.0000	.25252	.57371
CSTC 1	.27535***	.07945	3.47	.0005	.11963	.43107
CSTD 1	-.12704	.08524	-1.49	.1361	-.29410	.04002
CSTE 1	.25096***	.08053	3.12	.0018	.09312	.40881
CSTF 1	-.03814***	.00830	-4.59	.0000	-.05442	-.02187
ASCD 1	.36529***	.12958	2.82	.0048	.11132	.61925

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

Normal exit: 25 iterations. Status=0, F= 5626.490

```

-----
--
Latent Class Logit Model
Dependent variable      CHOICE
Log likelihood function -5626.49005
Restricted log likelihood -7164.36926

```

```

Chi squared [ 15 d.f.]      3075.75841
Significance level          .00000
McFadden Pseudo R-squared  .2146566
Estimation based on N =    5168, K = 15
Inf.Cr.AIC = 11283.0 AIC/N = 2.183
Model estimated: Dec 21, 2019, 17:23:11
Constants only must be computed directly
      Use NLOGIT ;...;RHS=ONE$
At start values -6169.5390 .0880*****
Response data are given as ind. choices
Number of latent classes = 2
Average Class Probabilities
      .694 .306
LCM model with panel has    646 groups
Fixed number of obsrvs./group= 8
Number of obs.= 5168, skipped 0 obs

```

```

-----+-----
--
      |
      | CHOICE| Coefficient      Standard      Prob.      95% Confidence
      |      |      Error          z          |z|>Z*      Interval
      |-----+-----
--
      |
      | Utility parameters in latent class -->> 1
CSTA|1| 1.44589***      .10522      13.74      .0000      1.23966      1.65211
CSTB|1| .47616***         .10474       4.55      .0000      .27087      .68145
CSTC|1| .43879***         .10298       4.26      .0000      .23695      .64063
CSTD|1| .09762           .11218       .87       .3842     -.12226     .31749
CSTE|1| .44453***         .10327       4.30      .0000      .24212     .64694
CSTF|1| -.03576***        .01086      -3.29     .0010     -.05704     -.01448
ASCD|1| -1.28093***       .21286      -6.02     .0000     -1.69813    -.86373
      |
      | Utility parameters in latent class -->> 2
CSTA|2| 2.11238***       .19640      10.76     .0000      1.72744     2.49732
CSTB|2| .21106           .17563       1.20     .2295     -.13317     .55529
CSTC|2| -.34810*          .18747      -1.86     .0633     -.71553     .01932
CSTD|2| -1.05771***      .19454      -5.44     .0000     -1.43900    -.67642
CSTE|2| -.48120**        .18877      -2.55     .0108     -.85118     -.11121
CSTF|2| -.06795***      .01760      -3.86     .0001     -.10244     -.03346
ASCD|2| 1.07110***     .29370       3.65     .0003      .49547     1.64674
      |
      | Estimated latent class probabilities
PrbCls1| .69354***       .02309      30.03     .0000      .64828     .73880
PrbCls2| .30646***       .02309      13.27     .0000      .26120     .35172
-----+-----
--

```

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

The two class LCM found respondents split into Class 1: those who valued all attributes at varying levels with HARDY being the most valued attribute and RARE IN THE WILD being the least valued attribute, plants with higher prices **less** likely to be chosen and NO CHOICE having a negative utility which shows that respondents in Class 1 considered not choosing a plant to be detrimental and Class 2: those who valued plants labelled as HARDY and NAMED CULTIVAR but were less likely to choose plants labelled as having KWP, RARE IN CULTIVATION, RARE IN THE WILD and plants with higher prices. For this group NO CHOICE had a positive utility which shows that respondents in Class 2 are more prepared not to choose a plant. Given that only HARDY and NAMED CULTIVAR have positive utility this would imply that, for Class 2 respondents, plants that were HARDY and a NAMED CULTIVAR were the only ones of interest.

Attribute	Coeff	Lower CI	Higer CI	Lower err	Upper err	Standard error	Probability
HARDY	1.45	1.24	1.65	0.21	0.21	0.11	0.00

NAMED CULTIVAR	0.48	0.27	0.68	0.21	0.21	0.10	0.00
RARE IN CULTIVATION	0.44	0.24	0.64	0.20	0.20	0.10	0.00
RARE IN WILD	0.10	-0.12	0.32	0.22	0.22	0.11	0.38
KWP	0.44	0.24	0.65	0.20	0.20	0.10	0.00
COST	-0.04	-0.06	-0.01	0.02	0.02	0.02	0.00
NO CHOICE	-1.28	-1.70	-0.86	0.42	0.42	0.21	0.00

Attribute	Coeff	Lower CI	Higer CI	Lower err	Upper err	Standard error	Probability
HARDY	2.11	1.73	2.50	0.38	0.38	0.20	0.00
NAMED CULTIVAR	0.21	-0.13	0.56	0.34	0.34	0.18	0.23
RARE IN CULTIVATION	-0.35	-0.72	0.02	0.37	0.37	0.19	0.06
RARE IN WILD	-1.06	-1.44	-0.68	0.38	0.38	0.19	0.00
KWP	-0.48	-0.85	-0.11	0.37	0.37	0.19	0.01
COST	-0.07	-0.10	-0.03	0.03	0.03	0.18	0.00
NO CHOICE	1.07	0.50	1.65	0.58	0.58	0.29	0.00

## 8.2 2 Class model Willingness to Pay (WTP)

### 8.2.1 Code and Output

```

|-> Wald;

    Pts=1000;
    Labels =
    b1,    b2,    b3,    b4,    b5,    b6,    a1,
    c1,    c2,    c3,    c4,    c5,    c6,    d1,
e1,e2;
    Start =      b;
    Var    =      varb;
    Fn1    =      b1/b6;
    Fn2    =      b2/b6;
    Fn3    =      b3/b6;
    Fn4    =      b4/b6;
    Fn5    =      b5/b6;
    Fn6    =      c1/c6;
    Fn7    =      c2/c6;
    Fn8    =      c3/c6;
    Fn9    =      c4/c6;
    Fn10   =      c5/c6$

```

```

-----
--
WALD procedure. Estimates and standard errors
for nonlinear functions and joint test of
nonlinear restrictions.

```

```

Wald Statistic      =      174.48546
Prob. from Chi-squared[10] =      .00000
Functions are computed at means of variables

```

	WaldFncns	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Fncn (1)		-40.4344***	9.72896	-4.16	.0000	-59.5028	-21.3660
Fncn (2)		-13.3160***	1.85404	-7.18	.0000	-16.9498	-9.6821
Fncn (3)		-12.2708***	1.65469	-7.42	.0000	-15.5139	-9.0277
Fncn (4)		-2.72985	2.41346	-1.13	.2580	-7.46015	2.00045
Fncn (5)		-12.4314***	1.72028	-7.23	.0000	-15.8031	-9.0597
Fncn (6)		-31.0862***	6.43541	-4.83	.0000	-43.6993	-18.4730
Fncn (7)		-3.10606	2.01888	-1.54	.1239	-7.06299	.85087
Fncn (8)		5.12273	3.88217	1.32	.1870	-2.48618	12.73163
Fncn (9)		15.5655**	6.45409	2.41	.0159	2.9157	28.2153
Fncn (10)		7.08139	4.38205	1.62	.1061	-1.50727	15.67006

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

WTP values for the two class LCM showed that in Class 1 HARDY had the highest WTP value at £40.43 with all other attributes being valued less and RARE IN THE WILD having the lowest WTP value and KWP was given a WTP of £12.43. For Class 2 HARDY had a WTP of £31.08 and NAMED CULTIVAR had a WTP of £3.11 whilst all other attributes had WTA values associated with them suggesting that respondents would not purchase these plants without discount.

COST - £2, £4, £7, £10, £14, £20	WTP (£)	
	Class 1	Class 2
HARDY	40.43	31.08
NAMED CULTIVAR	13.32	3.11
RARE IN CULTIVATION	12.27	-5.12
RARE IN WILD	2.73	-15.57
KWP	12.43	-7.08

## 9 3 Class Latent Class Model

### 9.1 3 Class Attribute Coefficients with 95% Confidence Intervals

#### 9.1.1 Code and Output

```

|-> NLOGIT;
  Lhs      =      choice,      cset,      alti;
  Choices  =      a,          b,          c,          d;
  Model:
  U(a) =  csta*ATTB_A      +      cstb*ATTB_B      +
          cstc*ATTB_C      +      cstd*ATTB_D      +
          cste*ATTB_E      +      cstf*cost/
  U(b) =  csta*ATTB_A      +      cstb*ATTB_B      +
          cstc*ATTB_C      +      cstd*ATTB_D      +
          cste*ATTB_E      +      cstf*cost/
  U(c) =  csta*ATTB_A      +      cstb*ATTB_B      +
          cstc*ATTB_C      +      cstd*ATTB_D      +
          cste*ATTB_E      +      cstf*cost/
  U(d) =  ascd;
  LCM;
  pts=3;

```

PTS = 3; is added to the script to give a 3 class model



Pds = 8\$  
 Normal exit: 5 iterations. Status=0, F= 6169.598

```
-----
--
Discrete choice (multinomial logit) model
Dependent variable      Choice
Log likelihood function -6169.59788
Estimation based on N = 5168, K = 7
Inf.Cr.AIC = 12353.2 AIC/N = 2.390
Model estimated: Dec 27, 2019, 17:09:02
R2=1-LogL/LogL* Log-L fncn R-sqrd R2Adj
Constants only must be computed directly
      Use NLOGIT ;...;RHS=ONE$
Response data are given as ind. choices
Number of obs.= 5168, skipped 0 obs
-----
+
```

```
-----
--
      |           Standard      Prob.      95% Confidence
      | Coefficient      Error      z      |z|>Z*      Interval
-----+-----
--
CSTA|1|  1.50800***    .08136    18.53   .0000    1.34853    1.66747
CSTB|1|  .41312***       .08194     5.04   .0000    .25252     .57371
CSTC|1|  .27535***       .07945     3.47   .0005    .11963     .43107
CSTD|1|  -.12704         .08524    -1.49   .1361   -.29410    .04002
CSTE|1|  .25096***       .08053     3.12   .0018    .09312     .40881
CSTF|1|  -.03814***      .00830    -4.59   .0000   -.05442    -.02187
ASCD|1|  .36529***       .12958     2.82   .0048    .11132     .61925
-----
+
```

```
-----
--
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
-----
--
```

Line search at iteration 50 does not improve fn. Exiting optimization.

```
-----
--
Latent Class Logit Model
Dependent variable      CHOICE
Log likelihood function -5351.86996
Restricted log likelihood -7164.36926
Chi squared [ 23 d.f.]  3624.99860
Significance level      .00000
McFadden Pseudo R-squared .2529880
Estimation based on N = 5168, K = 23
Inf.Cr.AIC = 10749.7 AIC/N = 2.080
Model estimated: Dec 27, 2019, 17:09:09
Constants only must be computed directly
      Use NLOGIT ;...;RHS=ONE$
At start values -6169.6289 .1325*****
Response data are given as ind. choices
Number of latent classes = 3
Average Class Probabilities
      .310 .415 .275
LCM model with panel has 646 groups
Fixed number of obsrvs./group= 8
Number of obs.= 5168, skipped 0 obs
-----
+
```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
-----						
--						
Utility parameters in latent class -->> 1						
CSTA 1	.81048***	.15608	5.19	.0000	.50456	1.11640
CSTB 1	.98898***	.15741	6.28	.0000	.68045	1.29751
CSTC 1	1.07944***	.16432	6.57	.0000	.75737	1.40150
CSTD 1	.78288***	.17459	4.48	.0000	.44068	1.12507
CSTE 1	.85533***	.15554	5.50	.0000	.55049	1.16018
CSTF 1	-.07259***	.01644	-4.41	.0000	-.10482	-.04037
ASCD 1	-.96229***	.30762	-3.13	.0018	-1.56521	-.35937
Utility parameters in latent class -->> 2						
CSTA 2	2.55445***	.20929	12.21	.0000	2.14425	2.96465
CSTB 2	-.05804	.20116	-.29	.7729	-.45231	.33623
CSTC 2	-.15912	.17701	-.90	.3687	-.50605	.18781
CSTD 2	-.73218***	.20181	-3.63	.0003	-1.12772	-.33664
CSTE 2	.11303	.18786	.60	.5474	-.25516	.48123
CSTF 2	-.55437D-04	.01985	.00	.9978	-.38968D-01	.38858D-01
ASCD 2	-.65495*	.34136	-1.92	.0550	-1.32400	.01410
Utility parameters in latent class -->> 3						
CSTA 3	1.86442***	.19525	9.55	.0000	1.48173	2.24710
CSTB 3	.22151	.18712	1.18	.2365	-.14523	.58826
CSTC 3	-.39100**	.19662	-1.99	.0467	-.77637	-.00563
CSTD 3	-1.09948***	.20610	-5.33	.0000	-1.50343	-.69553
CSTE 3	-.61251***	.19636	-3.12	.0018	-.99736	-.22766
CSTF 3	-.07336***	.01833	-4.00	.0001	-.10930	-.03743
ASCD 3	.88153***	.30719	2.87	.0041	.27944	1.48362
Estimated latent class probabilities						
PrbCls1	.30960***	.02218	13.96	.0000	.26614	.35307
PrbCls2	.41541***	.02481	16.75	.0000	.36679	.46403
PrbCls3	.27499***	.02018	13.63	.0000	.23544	.31453
-----						
--						
Note: nnnnn.D-xx or D+xx => multiply by 10 to -xx or +xx.						
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.						
-----						

## 9.2 3 Class Willingness to Pay (WTP)

### 9.2.1 Code and Output

```

|-> Wald;

    Pts=1000;
    Labels =
    b1,    b2,    b3,    b4,    b5,    b6,    a1,
    c1,    c2,    c3,    c4,    c5,    c6,    a2,
    d1,    d2,    d3,    d4,    d5,    d6,    a3,
    e1,e2,e3;
    Start =          b;
    Var =          varb;
    Fn1 =          b1/b6;
    Fn2 =          b2/b6;
    Fn3 =          b3/b6;
    Fn4 =          b4/b6;
    Fn5 =          b5/b6;
    Fn6 =          c1/c6;
    Fn7 =          c2/c6;
    Fn8 =          c3/c6;
    Fn9 =          c4/c6;
    Fn10 =         c5/c6;
    Fn11 =         d1/d6;
    Fn12 =         d2/d6;
    Fn13 =         d3/d6;
    Fn14 =         d4/d6;
    Fn15 =         d5/d6$

```

---

WALD procedure. Estimates and standard errors

for nonlinear functions and joint test of  
nonlinear restrictions.

Wald Statistic = 236.92250

Prob. from Chi-squared[15] = .00000

Functions are computed at means of variables

```

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```

WaldFcns	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Fncn(1)	-11.1644***	1.15618	-9.66	.0000	-13.4305	-8.8984
Fncn(2)	-13.6233***	1.45490	-9.36	.0000	-16.4749	-10.7718
Fncn(3)	-14.8694***	1.62788	-9.13	.0000	-18.0600	-11.6788
Fncn(4)	-10.7842***	1.07001	-10.08	.0000	-12.8814	-8.6870
Fncn(5)	-11.7823***	1.22349	-9.63	.0000	-14.1803	-9.3843
Fncn(6)	-46078.6	.1650D+08	.00	.9978	-32394940.6	32302783.4
Fncn(7)	1047.00	378348.5	.00	.9978	-740502.39	742596.38
Fncn(8)	2870.30	.1031D+07	.00	.9978	-2018078.07	2023818.66
Fncn(9)	13207.4	.4735D+07	.00	.9978	-9267039.0	9293453.9
Fncn(10)	-2038.94	727421.3	.00	.9978	-1427758.43	1423680.55
Fncn(11)	-25.4129***	4.85765	-5.23	.0000	-34.9338	-15.8921
Fncn(12)	-3.01935	2.02166	-1.49	.1353	-6.98174	.94303
Fncn(13)	5.32955	3.79242	1.41	.1599	-2.10344	12.76255
Fncn(14)	14.9865**	6.12747	2.45	.0145	2.9769	26.9961
Fncn(15)	8.34883*	4.50143	1.85	.0636	-.47381	17.17146

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Note: nnnnn.D-xx or D+xx => multiply by 10 to -xx or +xx.

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

### 9.3 3 Class LCM Analysis

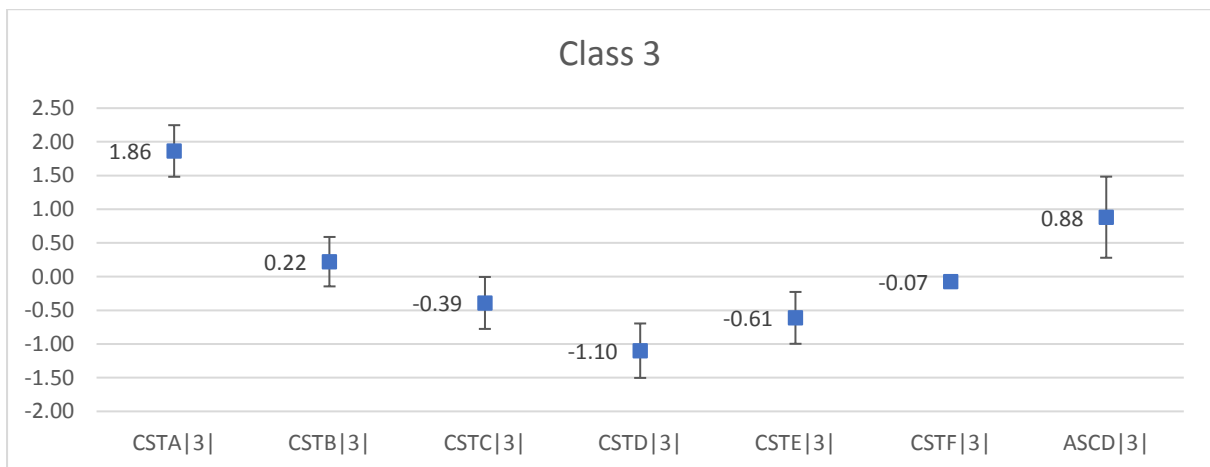
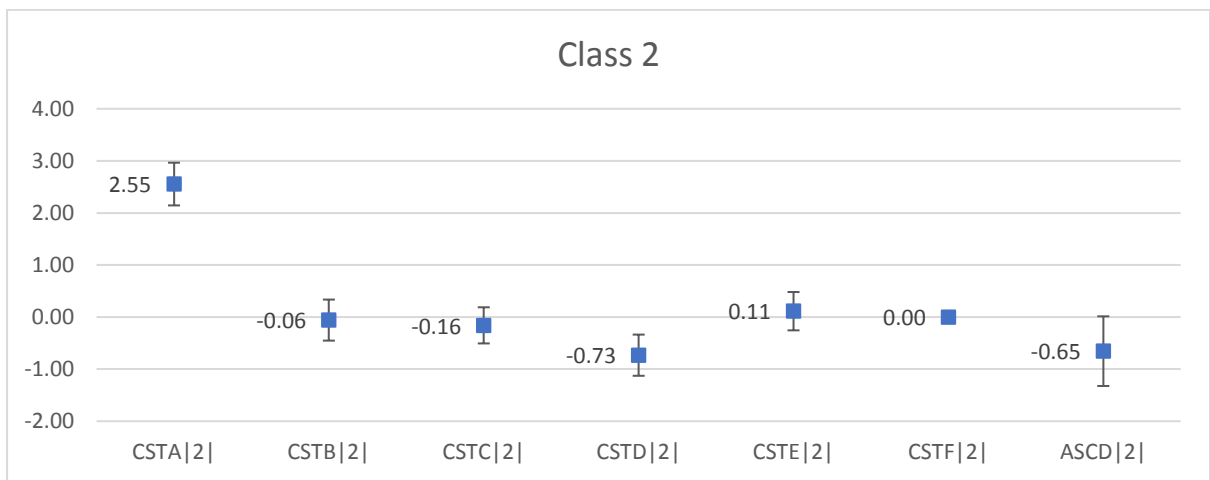
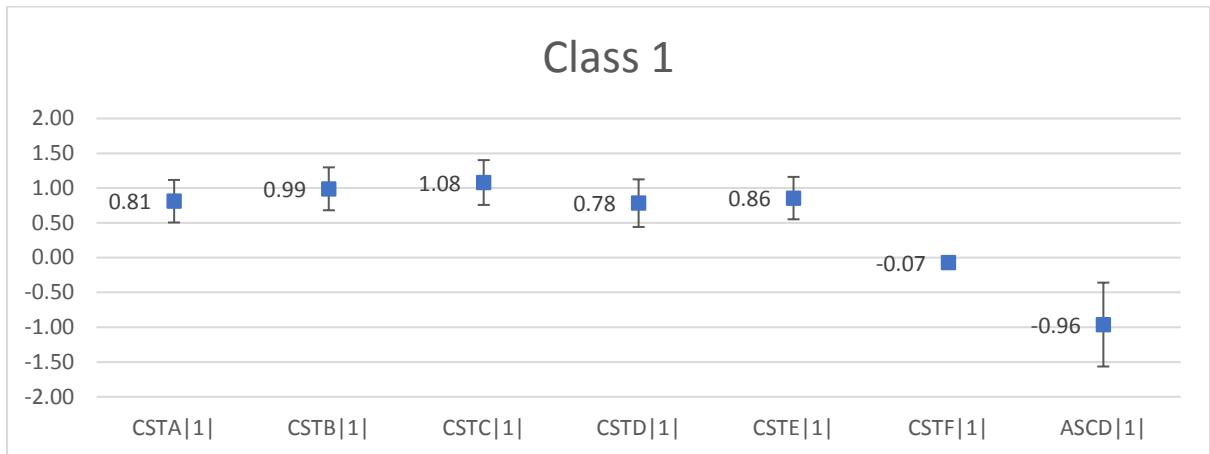
#### 9.3.1.1 3 Class LCM comparison tables and graphs

Attribute	Coeff	Lower CI	Higer CI	Standard error	Probability
HARDY	0.81	0.50	1.12	0.16	0.00
NAMED CULTIVAR	0.99	0.68	1.30	0.16	0.00
RARE IN CULTIVATION	1.08	0.76	1.40	0.16	0.00
RARE IN WILD	0.78	0.44	1.13	0.17	0.00
KWP	0.86	0.55	1.16	0.16	0.00
COST	-0.07	-0.10	-0.04	0.02	0.00
NO CHOICE	-0.96	-1.57	-0.36	0.31	0.00

Attribute	Coeff	Lower CI	Higer CI	Standard error	Probability
HARDY	2.55	2.14	2.96	0.21	0.00
NAMED CULTIVAR	-0.06	-0.45	0.34	0.20	0.77
RARE IN CULTIVATION	-0.16	-0.51	0.19	0.18	0.37
RARE IN WILD	-0.73	-1.13	-0.34	0.20	0.00
KWP	0.11	-0.26	0.48	0.19	0.55
COST	0.00	-0.04	0.04	0.00	-0.04
NO CHOICE	-0.65	-1.32	0.01	0.34	0.06

Attribute	Coeff	Lower CI	Higer CI	Standard error	Probability
HARDY	1.86	1.48	2.25	0.20	0.00
NAMED CULTIVAR	0.22	-0.15	0.59	0.19	0.24
RARE IN CULTIVATION	-0.39	-0.78	-0.01	0.20	0.05

RARE IN WILD	-1.10	-1.50	-0.70	0.21	0.00
KWP	-0.61	-1.00	-0.23	0.20	0.00
COST	-0.07	-0.11	-0.04	0.02	0.00
NO CHOICE	0.88	0.28	1.48	0.31	0.00



All things being equal, for respondents in Class 1:

#### 9.3.1.2 Positive utility -

- All attributes have a positive utility apart from COST
- A plant that is labelled as RARE IN CULTIVATION is **more** likely to be chosen than a plant that is not labelled as such. This attribute has the highest utility and is the most important attribute of those offered.
- A plant that is labelled as a NAMED CULTIVAR is **more** likely to be chosen than a plant that isn't labelled as such. This attribute has the second highest utility it is marginally less important than a plant labelled as RARE IN CULTIVATION.
- A plant that has KWP data on its label is **more** likely to be chosen than a plant that is not labelled as such. This attribute has the third highest utility; however, it is 1.26 times less important than a plant labelled as RARE IN CULTIVATION. This equates to 79.24% of the utility of RARE IN CULTIVATION.
- A plant that is labelled as HARDY is **more** likely to be chosen than a plant that isn't labelled as such. This attribute has the fourth highest utility; however, it is 1.33 times less important than a plant labelled as RARE IN CULTIVATION. This equates to 75.08% of the utility of RARE IN CULTIVATION.
- A plant that is labelled as RARE IN THE WILD is **more** likely to be chosen than a plant that isn't labelled as such. This attribute has the lowest utility of each of the attributes for Class 1; it is 1.38 times less important than a plant labelled as RARE IN CULTIVATION. This equates to 72.53% of the utility of RARE IN CULTIVATION. This is the least selected for attribute other than COST.

#### 9.3.1.3 Negative utility -

- Plants with higher prices are **less** likely to be chosen.

#### 9.3.1.4 No Choice -

- NO CHOICE has a negative utility which shows that respondents in Class 1 consider not choosing a plant to be detrimental.

All things being equal, for respondents in Class 2:

#### 9.3.1.5 Positive utility -

- A plant that is labelled as HARDY is **more** likely to be chosen than a plant that is not labelled as such. This attribute has the highest utility value, 2.55, and is the most important attribute of those offered.
- A plant that is labelled as having KWP is **more** likely to be chosen than a plant that isn't labelled as such. This attribute has the second highest utility for the attributes; however, it is 22.60 times less important than a plant labelled as HARDY. This equates to 4.42% of the utility of HARDY.

#### 9.3.1.6 Negative utility -

- All other attributes have a negative utility.
- A plant that is labelled as RARE IN THE WILD is **less** likely to be chosen than a plant that is not labelled as such. The detrimental impact of a plant being labelled as having KWP is the equivalent of 28.66% of the positive impact of a plant being labelled as HARDY. This equates to the positive impact of HARDY having a magnitude which is 3.48 times the detrimental impact of KWP.
- A plant that is labelled as RARE IN CULTIVATION is **less** likely to be chosen than a plant that is not labelled as such. The detrimental impact of a plant being labelled as RARE IN

CULTIVATION is the equivalent of 6.23% of the positive impact of a plant being labelled as HARDY. This equates to the positive impact of HARDY having a magnitude which is 16.05 times the detrimental impact of RARE IN CULTIVATION.

- A plant that is labelled as NAMED CULTIVAR is **less** likely to be chosen than a plant that is not labelled as such. The detrimental impact of a plant being labelled as NAMED CULTIVAR is the equivalent of 44.01% of the positive impact of a plant being labelled as HARDY. This equates to the positive impact of HARDY having a magnitude which is 2.27 times the detrimental impact of RARE IN THE WILD. It is, thus, the least impactful attribute.
- Plants with higher prices are **less** likely to be chosen. However, the magnitude of the coefficient for COST is very small (0 to four decimal places) and the confidence interval goes from positive to negative which suggests that respondents in this class were little affected by COST.

#### 9.3.1.7 *No Choice –*

- NO CHOICE has a negative utility which shows that respondents in Class 2 consider not choosing a plant to be detrimental.

All things being equal, for respondents in Class 3:

#### 9.3.1.8 *Positive utility -*

- A plant that is labelled as HARDY is **more** likely to be chosen than a plant that is not labelled as such. This attribute has the highest utility and is the most important attribute of those offered.
- A plant that is labelled as a NAMED CULTIVAR is **more** likely to be chosen than a plant that isn't labelled as such. This attribute has the second highest utility; however, it is 8.42 times less important than a plant labelled as HARDY. This equates to 11.88% of the utility of HARDY.

#### 9.3.1.9 *Negative utility -*

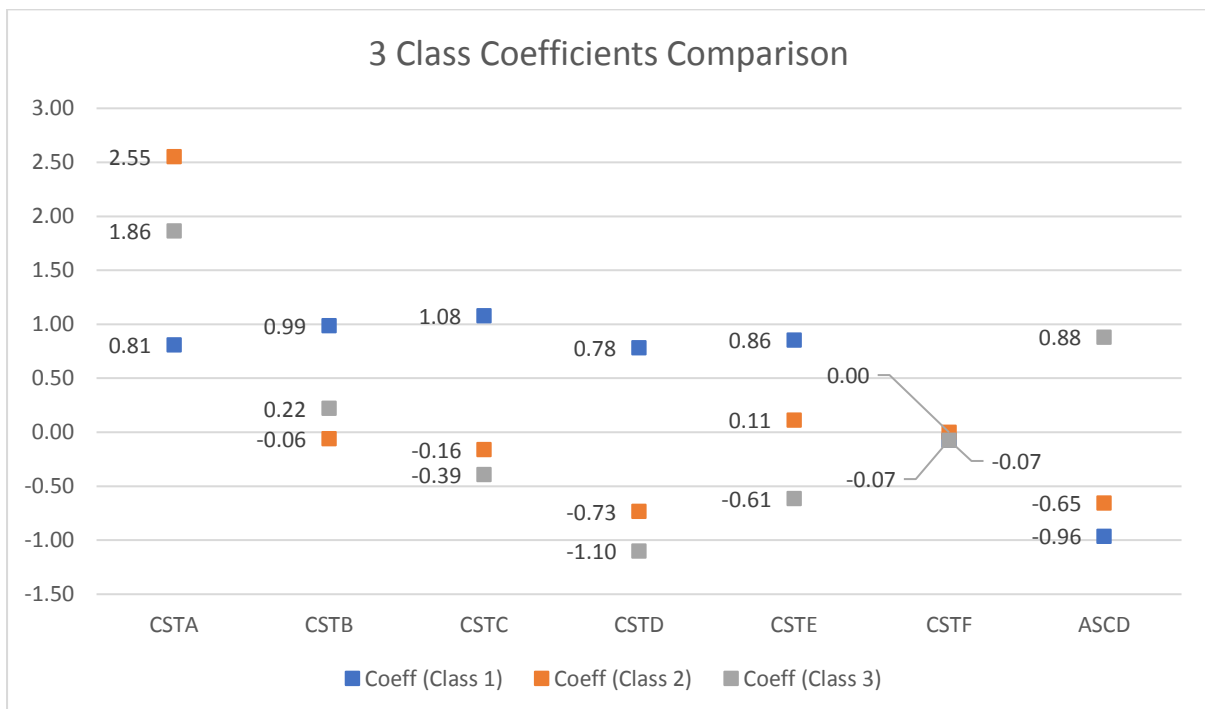
- All other attributes have a negative utility.
- A plant that is labelled as RARE IN THE WILD is **less** likely to be chosen than a plant that is not labelled as such. The detrimental impact of a plant being labelled as having KWP is the equivalent of 58.97% of the positive impact of a plant being labelled as HARDY. This equates to the positive impact of HARDY having a magnitude which is 1.70 times the detrimental impact of KWP.
- A plant that is labelled as having KWP is **less** likely to be chosen than a plant that is not labelled as such. The detrimental impact of a plant being labelled as having KWP is the equivalent of 32.85% of the positive impact of a plant being labelled as HARDY. This equates to the positive impact of HARDY having a magnitude which is 3.04 times the detrimental impact of KWP.
- A plant that is labelled as RARE IN CULTIVATION is **less** likely to be chosen than a plant that is not labelled as such. The detrimental impact of a plant being labelled as RARE IN CULTIVATION is the equivalent of 20.97% of the positive impact of a plant being labelled as HARDY. This equates to the positive impact of HARDY having a magnitude which is 4.77 times the detrimental impact of RARE IN CULTIVATION. It is, thus, the least impactful attribute.
- Plants with higher prices are **less** likely to be chosen.

9.3.1.10 No Choice -

- NO CHOICE has a positive utility which shows that respondents in Class 3 are more prepared not to choose a plant. Given that only HARDY and NAMED CULTIVAR have positive utility this would imply that, for Class 3 respondents, plants that were HARDY and a NAMED CULTIVAR were the only ones of interest.

9.3.1.11 3 Class Comparison.

Attribute	Choice	Coeff (Class 1)	Coeff (Class 2)	Coeff (Class 3)
HARDY	CSTA	0.81	2.55	1.86
NAMED CULTIVAR	CSTB	0.99	-0.06	0.22
RARE IN CULTIVATION	CSTC	1.08	-0.16	-0.39
RARE IN WILD	CSTD	0.78	-0.73	-1.10
KWP	CSTE	0.86	0.11	-0.61
COST	CSTF	-0.07	0.00	-0.07
NO CHOICE	ASCD	-0.96	-0.65	0.88



- HARDY is the most selected attribute in Class 2 and Class 3 but is only the fourth most important attribute in Class 1. The utility for HARDY in Class 1 is 31.73% of that of Class 2 and 43.47% of that of Class 3. This implies that respondents in Class 2 and 3 selected plants for hardiness **more** than Class 1.
- NAMED CULTIVAR has the second highest utility of any attribute in Classes 1 and 3. The utility for NAMED CULTIVAR in Class 2 is 31.73% of that of Class 1 and 43.47% of that of Class 3. This implies that respondents in Class 2 and 3 selected plants for hardiness **more** than Class 1.
- RARE IN CULTIVATION has the highest utility in Class 1 but has the 3<sup>rd</sup> most detrimental utility of any attribute in Classes 2 and 3. The detrimental impact of a plant being labelled RARE IN CULTIVATION in Class 2 is the equivalent of 14.74% of its positive impact in Class 1.



The detrimental impact of a plant being labelled RARE IN CULTIVATION in Class 3 is the equivalent of 36.22% of its positive impact in Class 1.

- KWP has the second highest utility of any attribute in Class 2 and the third highest utility of any attribute in Class 1. KWP is the second most detrimental utility of any attribute in Class 3. The utility for KWP in Class 2 is 13.21% of that of Class 1 but the detrimental impact of KWP in Class 3 is the equivalent of 71.61% of its positive impact in Class 1.
- RARE IN WILD has the lowest utility of any attribute in all classes. RARE IN WILD has a positive utility in Class 1 but a negative utility in Class 2 and 3. The detrimental impact of a plant being labelled RARE IN WILD in Class 2 is the equivalent of 93.52% of its positive impact in Class 1. The detrimental impact of a plant being labelled RARE IN WILD in Class 3 is the equivalent of 140.44% of its positive impact in Class 1.
- No class chose plants with higher prices.
- The utility of NO CHOICE in Class 3 is positive whilst in Class 1 and 2 it is negative. The magnitude of the utility of NO CHOICE in Class 3 is 0.93 times that of Class 1 and 1.35 times that of Class 2. This means that respondents in Class 1 and 2 are less likely to choose NO CHOICE than those in Class 3.

#### 9.3.1.12 95% Confidence Intervals comparison

- The 95% CI for each of the 5 attributes in Class 1 are each about equal to one another as are the 95% CI for Class 2 and Class 3. In each case they fall within a narrow margin of the coefficient with the 95% CI for Class 3 slightly wider across all attributes.
- The 95% CI for NO CHOICE is approximately equal for all classes.

#### 9.3.1.13 Average Class Probabilities

- The probability of a randomly chosen respondent being in Class 1 is 0.310
- The probability of a randomly chosen respondent being in Class 2 is 0.415
- The probability of a randomly chosen respondent being in Class 3 is 0.275
- This means approximately 31% of respondents fall into Class1, 42% fall into Class 2 and 28% fall into Class 3.

### 9.3.2 3 class Willingness to Pay (WTP) Analysis

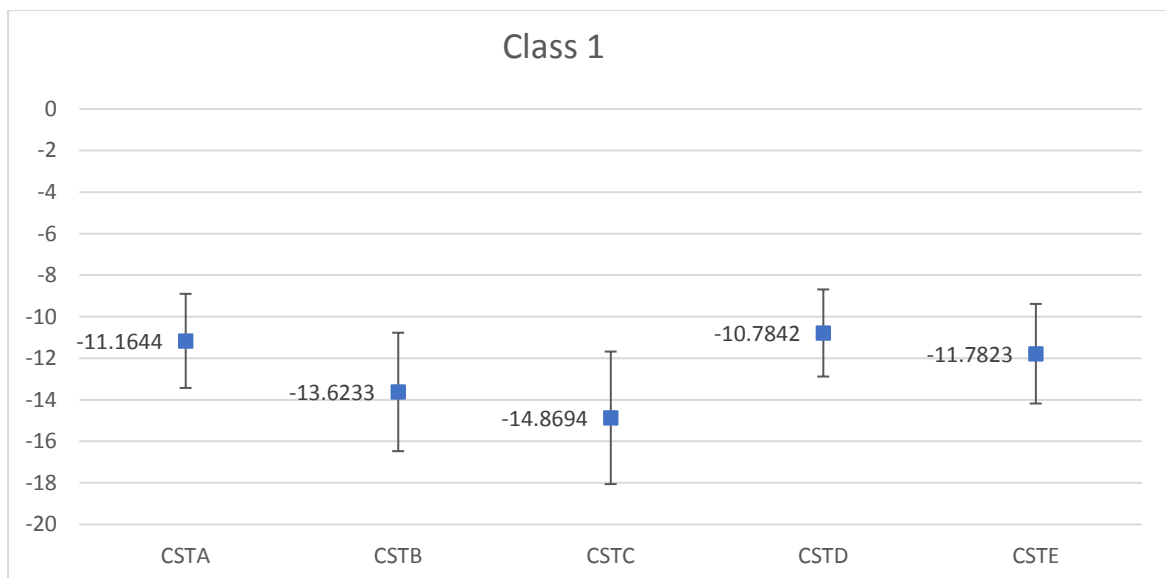
#### 9.3.2.1 3 class WTP comparison tables and graphs

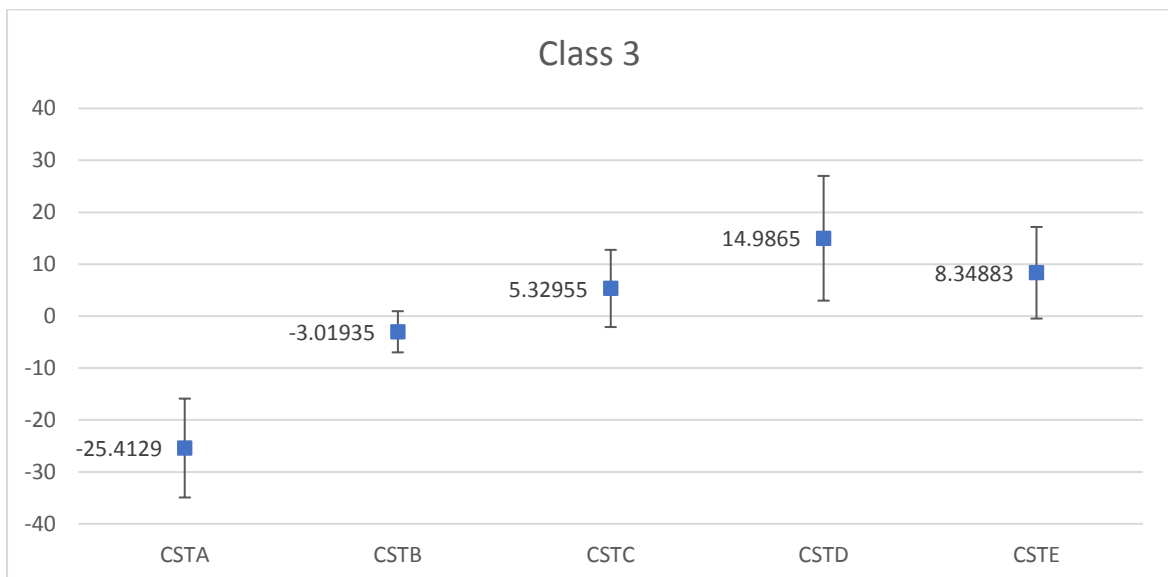
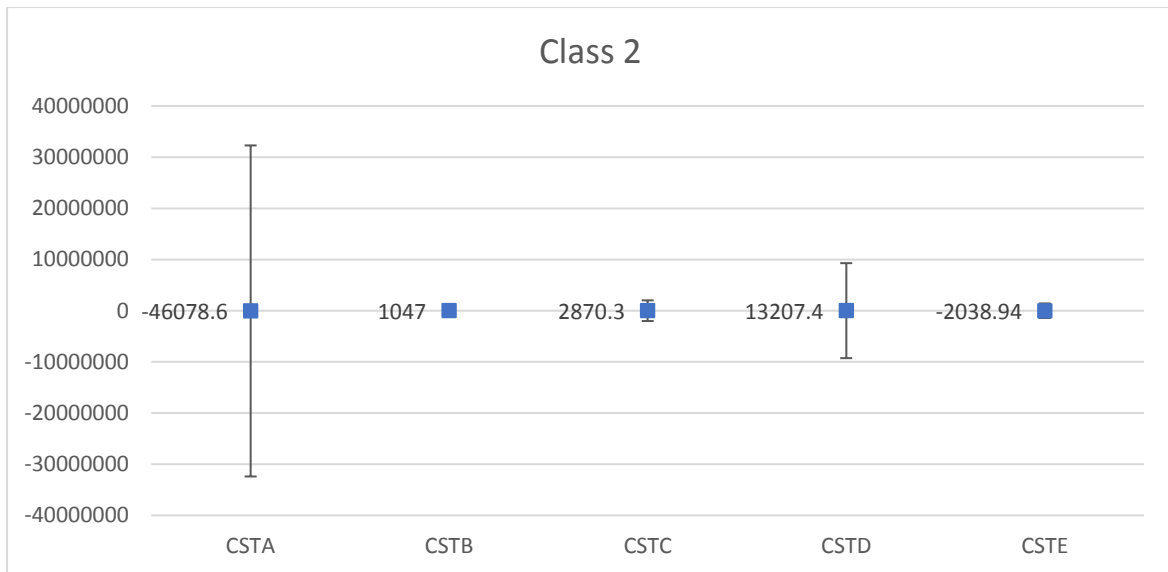
	WaldFcns	WTP Coeff	Lower CI	Higer CI	Standard error	Probability
HARDY	Fncn(1)	-11.16	-13.43	-8.90	1.16	0.00
NAMED CULTIVAR	Fncn(2)	-13.62	-16.47	-10.77	1.45	0.00
RARE IN CULTIVATION	Fncn(3)	-14.87	-18.06	-11.68	1.63	0.00
RARE IN THE WILD	Fncn(4)	-10.78	-12.88	-8.69	1.07	0.00
KWP	Fncn(5)	-11.78	-14.18	-9.38	1.22	0.00

	WaldFcns	WTP Coeff	Lower CI	Higer CI	Standard error	Probability
HARDY	Fncn(1)	-46078.60	-32394940.60	32302783.40	0.00	1.00

NAMED CULTIVAR	Fncn(2)	1047.00	-740502.39	742596.38	378348.50	1.00
RARE IN CULTIVATION	Fncn(3)	2870.30	-2018078.07	2023818.66	0.00	1.00
RARE IN THE WILD	Fncn(4)	13207.40	-9267039.00	9293453.90	0.00	1.00
KWP	Fncn(5)	-2038.94	-1427758.43	1423680.55	727421.30	1.00

	WaldFcns	WTP Coeff	Lower CI	Higer CI	Standard error	Probability
HARDY	Fncn(1)	-25.41	-34.93	-15.89	4.86	0.00
NAMED CULTIVAR	Fncn(2)	-3.02	-6.98	0.94	2.02	0.14
RARE IN CULTIVATION	Fncn(3)	5.33	-2.10	12.76	3.79	0.16
RARE IN THE WILD	Fncn(4)	14.99	2.98	27.00	6.13	0.01
KWP	Fncn(5)	8.35	-0.47	17.17	4.50	0.06





	WTP value (£) Class 1	WTP value (£) Class 2	WTP Value (£) Class 3
HARDY	£11.16	£46078.60	£25.41
NAMED CULTIVAR	£13.62	-£1047.00	£3.02
RARE IN CULTIVATION	£14.87	-£2870.30	-£5.33
RARE IN THE WILD	£10.78	-£13207.40	-£14.99
KWP	£11.78	£2038.94	-£8.35

9.3.2.2 Class 1 Positive WTP:

- RARE IN CULTIVATION has a WTP value of £14.87 which is the highest WTP value of any attribute offered to respondents
- NAMED CULTIVAR has a WTP of £13.62. This is £1.25 less than that of RARE IN CULTIVATION
- KWP has a WTP of £11.78. This is £3.09 less than that of RARE IN CULTIVATION.
- HARDY has a WTP of £11.16. This is £3.71 less than that of RARE IN CULTIVATION.
- RARE IN THE WILD has a WTP of £10.78. This is £4.09 less than that of RARE IN CULTIVATION. RARE IN THE WILD has the lowest WTP of any attribute for Class 1.

#### 9.3.2.3 Class 1 Negative WTP:

No attributes in Class 1 had a negative WTP.

#### 9.3.2.4 95% Confidence Interval comparison

- 95% CI were similar for all attributes with the lowest deviation from the WTP point estimate being £2.10 for RARE IN WILD and the highest deviation from the WTP point estimate being £3.19 for RARE IN CULTIVATION.

#### 9.3.2.5 Class 2

The WTP values for Class 2 in the 3 Class LCM are substantially larger than those for either of the other two classes, this is because the magnitude for the coefficient for COST is very small.

#### 9.3.2.6 Class 2 Positive WTP: -

- HARDY has a WTP value of £46078.60 which is the highest WTP value of any attribute offered to respondents
- KWP has a WTP value of £2038.94 which is £44039.66 less than that of HARDY.

#### 9.3.2.7 Class 2 Negative WTP:

- All other attributes show a negative WTP meaning that this reduces the price a respondent from Class 2 is prepared to pay for a plant.
- NAMED CULTIVAR reduces the price a member of Class 2 is prepared to pay by £1047
- RARE IN CULTIVATION reduces the price a member of Class 2 is prepared to pay by £2870.30
- RARE IN WILD reduces the price a member of Class 2 is prepared to pay by £13207.40

#### 9.3.2.8 Class 2 95% Confidence Intervals

- 95% CI were exceptionally large for all attributes, the size of the CI's make the WTP estimates very poor.

For class 2 of the 3 class LCM it can be interpreted that a group of respondents for which the options for price that were made available did not impact the choice they made. To rectify this if the experiment was done again higher COST options should be offered.

#### 9.3.2.8.1 Class 3

#### 9.3.2.8.2 Positive WTP:

- HARDY reduces the price a member of Class 2 is prepared to pay by £25.41 which is the highest WTP value of any attribute offered to respondents.
- NAMED CULTIVAR £ has a WTP value of £3.02 which is £22.39 less than that of HARDY.

#### 9.3.2.8.3 Negative WTP:

- RARE IN WILD reduces the price a member of Class 2 is prepared to pay by £14.99.
- KWP has a WTP reduces the price a member of Class 2 is prepared to pay by £8.35.
- RARE IN CULTIVATION reduces the price a member of Class 2 is prepared to pay by £5.33

#### 9.3.2.8.4 95% Confidence Intervals comparison

- 95% CI varied across attributes
- HARDY and RARE IN WILD had the highest deviations from the WTP point estimate.
- RARE IN WILD has a deviation which went from £27 to £2.98. This is a deviation of £12.01 from WTP point estimate
- HARDY has a deviation which went from £34.93 to £15.89. This is a deviation of £9.52 from WTP point estimate.

- The maximum deviation for all of the other attributes was £8.82 for KWP
- The lowest deviation for the other three attributes was £3.96 for NAMED CULTIVAR showing that NAMED CULTIVAR had the highest confidence.

## 10 3 Class Socio economic analysis

### 10.1 3 class Code with WTP for each socio econ group individually without K & R (Delta method).

#### 10.1.1 Socioeconomic headings

##### AGE -what age are you?

AGEBLANK	- no response
AGEPNTS	- Prefer not to say
AGE65	- 65+
AGE5564	- 55-64
AGE4554	- 45-54
AGE3544	- 35-44
AGE2534	- 25-34
AGE1824	- 18-24
LIVEOTH	- Other
LIVEPNTS	- Prefer not to say
LIVESCOT	- Scotland
LIVENIRL	- Northern Ireland
LIVBLANK	- no response
LIVESWAL	- South Wales
LIVENWAL	- North Wales
LIVESWEN	- South West (England)
LIVESEEN	- South East (England)
LIVELDN	- London
LIVEEEN	- East of England
LIVEWEN	- North West (England)
LIVEEMID	- East Midlands (England)
LIVEYHUM	- Humberside
LIVENEEN	- North East (England)
GENBLANK	- No response
GENPNTS	- Prefer not to say
GENNL	- Not listed
GENMS	- Female
GENMX	- Non-Binary
GENMR	- Male
GENDOTH	- Other
EDUBLANK	- No response
EDUUND	- Undergraduate degree
EDUSCH	- School education to 16
EDUPNTS	- Prefer not to say
EDUPOST	- Post-graduate degree
EDUHIGH	- Higher
EDUALEV	- A-level or equivalent

PROF - Are you employed in a profession linked to plants/horticulture? YES  
 PROFBLK - No Response

JOBBLANK - No Response  
 JOBUNEM - Unemployed  
 JOBSELF - self employed  
 JOBRET - retired  
 JOBPNTS – Prefer not to say  
 JOBOTHER - other  
 JOBEMP – employed

SOC – Have you ever been a member of a gardening or plant society, group or club (including online groups on social media)? YES

10.1.2 3 Class Attribute Coefficients with 95% Confidence Intervals and WTP for each socio-economic group individually – Code and output.

Yellow highlighting denotes 1% \*\*\*, 5% \*\*, 10% \* Significance in Class 1.

Green highlighting denotes 1% \*\*\*, 5% \*\*, 10% \* Significance in Class 2.

Blue highlighting denotes 1% \*\*\*, 5% \*\*, 10% \* Significance for WTP Values in Class 2.

Red text denotes results of low significance and errors that require investigation

```
|-> NLOGIT;
  Lhs      =          choice,      cset,      alti;
  Choices  =          a,          b,          c,          d;
  Model:
  U(a)=  csta*ATTB_A      +          cstb*ATTB_B      +
         cstc*ATTB_C      +          cstd*ATTB_D      +
         cste*ATTB_E      +          cstf*cost/
  U(b)=  csta*ATTB_A      +          cstb*ATTB_B      +
         cstc*ATTB_C      +          cstd*ATTB_D      +
         cste*ATTB_E      +          cstf*cost/
  U(c)=  csta*ATTB_A      +          cstb*ATTB_B      +
         cstc*ATTB_C      +          cstd*ATTB_D      +
         cste*ATTB_E      +          cstf*cost/
  U(d)=  ascd;
  LCM= AGE;
  parameters;
  pts=3;
  Pds    =          8$;
Normal exit:   5 iterations. Status=0, F=          6169.598
```

-----  
 --

```
Discrete choice (multinomial logit) model
Dependent variable          Choice
Log likelihood function     -6169.59788
Estimation based on N =    5168, K =    7
Inf.Cr.AIC = 12353.2 AIC/N =    2.390
Model estimated: Jul 02, 2020, 13:28:42
R2=1-LogL/LogL* Log-L fncn R-sqrd R2Adj
Constants only must be computed directly
          Use NLOGIT ;...;RHS=ONE$
Response data are given as ind. choices
```

Number of obs.= 5168, skipped 0 obs

---

```
--
```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
CSTA 1	1.50800***	.08136	18.53	.0000	1.34853	1.66747
CSTB 1	.41312***	.08194	5.04	.0000	.25252	.57371
CSTC 1	.27535***	.07945	3.47	.0005	.11963	.43107
CSTD 1	-.12704	.08524	-1.49	.1361	-.29410	.04002
CSTE 1	.25096***	.08053	3.12	.0018	.09312	.40881
CSTF 1	-.03814***	.00830	-4.59	.0000	-.05442	-.02187
ASCD 1	.36529***	.12958	2.82	.0048	.11132	.61925

---

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

---

Line search at iteration 58 does not improve fn. Exiting optimization.

---

```
--
```

Latent Class Logit Model  
Dependent variable CHOICE  
Log likelihood function -5350.35361  
Restricted log likelihood -7164.36926  
Chi squared [ 25 d.f.] 3628.03129  
Significance level .00000  
McFadden Pseudo R-squared .2531996  
Estimation based on N = 5168, K = 25  
Inf.Cr.AIC = 10750.7 AIC/N = 2.080  
Model estimated: Jul 02, 2020, 13:28:48  
Constants only must be computed directly  
Use NLOGIT ;...;RHS=ONE\$  
At start values -6169.6289 .1328\*\*\*\*\*  
Response data are given as ind. choices  
Number of latent classes = 3  
Average Class Probabilities  
.311 .414 .274  
LCM model with panel has 646 groups  
Fixed number of obsrvs./group= 8  
Number of obs.= 5168, skipped 0 obs

---

```
--
```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Utility parameters in latent class -->> 1						
CSTA 1	.81564***	.15556	5.24	.0000	.51075	1.12053
CSTB 1	.98283***	.15680	6.27	.0000	.67550	1.29016
CSTC 1	1.07741***	.16440	6.55	.0000	.75520	1.39962
CSTD 1	.78251***	.17485	4.48	.0000	.43980	1.12522
CSTE 1	.85755***	.15527	5.52	.0000	.55323	1.16187
CSTF 1	-.07299***	.01641	-4.45	.0000	-.10515	-.04083
ASCD 1	-.97346***	.30707	-3.17	.0015	-1.57531	-.37161
Utility parameters in latent class -->> 2						
CSTA 2	2.56522***	.21092	12.16	.0000	2.15183	2.97860
CSTB 2	-.04855	.20271	-.24	.8107	-.44586	.34875

---

```

CSTC|2|    -.16088      .17719    -.91   .3639    -.50817   .18641
CSTD|2|    -.73420***    .20230    -3.63  .0003    -1.13070  -.33770
CSTE|2|     .10405      .18802     .55   .5800    -.26445   .47256
CSTF|2|     .00028      .01986     .01   .9888    -.03865   .03921
ASCD|2|    -.63342*      .34357    -1.84  .0652    -1.30681  .03996
|Utility parameters in latent class -->> 3
CSTA|3|    1.86369***    .19622     9.50  .0000     1.47910  2.24827
CSTB|3|     .22126      .18751     1.18  .2380    -.14626   .58878
CSTC|3|    -.39387**     .19686    -2.00  .0454    -.77970  -.00804
CSTD|3|   -1.10185***    .20878    -5.28  .0000    -1.51104  -.69266
CSTE|3|    -.61331***    .19658    -3.12  .0018    -.99860  -.22802
CSTF|3|    -.07312***    .01833    -3.99  .0001    -1.10906  -.03719
ASCD|3|     .88277***    .30855     2.86  .0042     .27803  1.48751
|This is THETA(01) in class probability model.
Constant|     .46253      .32585     1.42  .1558    -.17613   1.10119
  _AGE|1|    -.00819      .00721    -1.14  .2563    -.02233   .00595
|This is THETA(02) in class probability model.
Constant|     .31539      .32269     .98   .3284    -.31708   .94786
  _AGE|2|     .00227      .00699     .32   .7457    -.01143   .01596
|This is THETA(03) in class probability model.
Constant|         0.0      .....(Fixed Parameter).....
  _AGE|3|         0.0      .....(Fixed Parameter).....
-----+-----
--

```

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.  
Fixed parameter ... is constrained to equal the value or  
had a nonpositive st.error because of an earlier problem.

--

```

|->
|-> Wald;
  Pts=1000;
  Labels =
  b1,    b2,    b3,    b4,    b5,    b6,    a1,
  c1,    c2,    c3,    c4,    c5,    c6,    a2,
  d1,    d2,    d3,    d4,    d5,    d6,    a3,
  e1,e2,e3,e4,e5,e6;
  Start =          b;
  Var    =          varb;
  Fn1    =          b1/b6;
  Fn2    =          b2/b6;
  Fn3    =          b3/b6;
  Fn4    =          b4/b6;
  Fn5    =          b5/b6;
  Fn6    =          c1/c6;
  Fn7    =          c2/c6;
  Fn8    =          c3/c6;
  Fn9    =          c4/c6;
  Fn10   =          c5/c6;
  Fn11   =          d1/d6;
  Fn12   =          d2/d6;
  Fn13   =          d3/d6;
  Fn14   =          d4/d6;
  Fn15   =          d5/d6$;

```

-----+-----  
--  
WALD procedure. Estimates and standard errors  
for nonlinear functions and joint test of  
nonlinear restrictions.



Wald Statistic = 239.88146  
 Prob. from Chi-squared[15] = .00000  
 Functions are computed at means of variables

```
-----+-----
```

WaldFcns	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Fncn(1)	-11.1754***	1.15395	-9.68	.0000	-13.4371	-8.9137
Fncn(2)	-13.4662***	1.43462	-9.39	.0000	-16.2780	-10.6544
Fncn(3)	-14.7619***	1.59065	-9.28	.0000	-17.8796	-11.6443
Fncn(4)	-10.7214***	1.06409	-10.08	.0000	-12.8070	-8.6359
Fncn(5)	-11.7496***	1.21089	-9.70	.0000	-14.1229	-9.3763
Fncn(6)	9185.34	653939.5	.01	.9888	-1272512.45	1290883.14
Fncn(7)	-173.852	11721.77	-.01	.9882	-23148.091	22800.387
Fncn(8)	-576.073	40416.71	-.01	.9886	-79791.374	78639.228
Fncn(9)	-2628.96	186338.0	-.01	.9887	-367844.70	362586.79
Fncn(10)	372.580	27105.17	.01	.9890	-52752.586	53497.746
Fncn(11)	-25.4878***	4.89277	-5.21	.0000	-35.0775	-15.8982
Fncn(12)	-3.02595	2.03322	-1.49	.1367	-7.01098	.95909
Fncn(13)	5.38661	3.81991	1.41	.1585	-2.10028	12.87350
Fncn(14)	15.0689**	6.18105	2.44	.0148	2.9543	27.1835
Fncn(15)	8.38762*	4.52704	1.85	.0639	-.48523	17.26046

```
-----+-----
```

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

```

--
--
--> NLOGIT;
  Lhs = choice, cset, alti;
  Choices = a, b, c, d;
  Model:
  U(a)= csta*ATTB_A + cspb*ATTB_B +
         cstc*ATTB_C + cstd*ATTB_D +
         cste*ATTB_E + cstf*cost/
  U(b)= csta*ATTB_A + cspb*ATTB_B +
         cstc*ATTB_C + cstd*ATTB_D +
         cste*ATTB_E + cstf*cost/
  U(c)= csta*ATTB_A + cspb*ATTB_B +
         cstc*ATTB_C + cstd*ATTB_D +
         cste*ATTB_E + cstf*cost/
  U(d)= ascd;
  LCM= AGEBLANK;
  parameters;
  pts=3;
  Pds = 8$;
Normal exit: 5 iterations. Status=0, F= 6169.598

```

```

-----+-----
--
Discrete choice (multinomial logit) model
Dependent variable Choice
Log likelihood function -6169.59788
Estimation based on N = 5168, K = 7
Inf.Cr.AIC = 12353.2 AIC/N = 2.390
Model estimated: Jul 02, 2020, 13:28:49
R2=1-LogL/LogL* Log-L fncn R-sqrd R2Adj
Constants only must be computed directly
Use NLOGIT ;...;RHS=ONE$

```

Response data are given as ind. choices  
 Number of obs.= 5168, skipped 0 obs

```
-----+-----
```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
CSTA 1	1.50800***	.08136	18.53	.0000	1.34853	1.66747
CSTB 1	.41312***	.08194	5.04	.0000	.25252	.57371
CSTC 1	.27535***	.07945	3.47	.0005	.11963	.43107
CSTD 1	-.12704	.08524	-1.49	.1361	-.29410	.04002
CSTE 1	.25096***	.08053	3.12	.0018	.09312	.40881
CSTF 1	-.03814***	.00830	-4.59	.0000	-.05442	-.02187
ASCD 1	.36529***	.12958	2.82	.0048	.11132	.61925

```
-----+-----
```

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

Line search at iteration 50 does not improve fn. Exiting optimization.

```
-----+-----
```

Latent Class Logit Model  
 Dependent variable CHOICE  
 Log likelihood function -5349.45674  
 Restricted log likelihood -7164.36926  
 Chi squared [ 25 d.f.] 3629.82504  
 Significance level .00000  
 McFadden Pseudo R-squared .2533248  
 Estimation based on N = 5168, K = 25  
 Inf.Cr.AIC = 10748.9 AIC/N = 2.080  
 Model estimated: Jul 02, 2020, 13:28:55  
 Constants only must be computed directly  
 Use NLOGIT ;...;RHS=ONE\$  
 At start values -6169.6289 .1329\*\*\*\*\*  
 Response data are given as ind. choices  
 Number of latent classes = 3  
 Average Class Probabilities  
 .310 .417 .273  
 LCM model with panel has 646 groups  
 Fixed number of obsrvs./group= 8  
 Number of obs.= 5168, skipped 0 obs

```
-----+-----
```

```
-----+-----
```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Utility parameters in latent class -->> 1						
CSTA 1	.81333***	.15580	5.22	.0000	.50797	1.11869
CSTB 1	.99018***	.15704	6.31	.0000	.68240	1.29797
CSTC 1	1.08110***	.16415	6.59	.0000	.75937	1.40283
CSTD 1	.78770***	.17484	4.51	.0000	.44501	1.13039
CSTE 1	.86041***	.15568	5.53	.0000	.55528	1.16553
CSTF 1	-.07301***	.01642	-4.45	.0000	-.10518	-.04083
ASCD 1	-.96205***	.30722	-3.13	.0017	-1.56420	-.35991
Utility parameters in latent class -->> 2						
CSTA 2	2.55343***	.20789	12.28	.0000	2.14598	2.96088

```
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```

```

CSTB|2|    -.05084      .20029      -.25   .7996      -.44341    .34173
CSTC|2|    -.15574      .17624      -.88   .3768      -.50116    .18967
CSTD|2|    -.73329***     .20029     -3.66  .0003     -1.12586   -.34073
CSTE|2|     .10806      .18689       .58   .5631      -.25823    .47435
CSTF|2|    -.00034      .01976      -.02   .9863      -.03906    .03838
ASCD|2|    -.63366*      .33829     -1.87  .0611     -1.29670   .02938
  |Utility parameters in latent class --> 3
CSTA|3|    1.86062***     .19673      9.46  .0000      1.47504    2.24620
CSTB|3|     .21967      .18785      1.17  .2422     -.14850    .58785
CSTC|3|    -.39672**     .19754     -2.01  .0446     -.78390   -.00955
CSTD|3|   -1.10087***     .20723     -5.31  .0000     -1.50702   -.69471
CSTE|3|    -.61834***     .19727     -3.13  .0017     -1.00499   -.23169
CSTF|3|    -.07349***     .01841     -3.99  .0001     -.10958   -.03741
ASCD|3|     .88026***     .30930      2.85  .0044      .27404    1.48649
  |This is THETA(01) in class probability model.
Constant|    .13820      .12060      1.15  .2518     -.09817    .37457
_AGE|1|    -.17033      .44532     -.38  .7021     -1.04314   .70248
  |This is THETA(02) in class probability model.
Constant|    .47492***     .11829      4.01  .0001      .24307    .70676
_AGE|2|   -.96116*     .49633     -1.94  .0528     -1.93395   .01164
  |This is THETA(03) in class probability model.
Constant|      0.0      ..... (Fixed Parameter) .....
_AGE|3|      0.0      ..... (Fixed Parameter) .....
-----+-----
--

```

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.  
Fixed parameter ... is constrained to equal the value or  
had a nonpositive st.error because of an earlier problem.

```

--
|->
|-> Wald;
  Pts=1000;
  Labels =
  b1,    b2,    b3,    b4,    b5,    b6,    a1,
  c1,    c2,    c3,    c4,    c5,    c6,    a2,
  d1,    d2,    d3,    d4,    d5,    d6,    a3,
  e1,e2,e3,e4,e5,e6;
  Start  =          b;
  Var    =          varb;
  Fn1    =          b1/b6;
  Fn2    =          b2/b6;
  Fn3    =          b3/b6;
  Fn4    =          b4/b6;
  Fn5    =          b5/b6;
  Fn6    =          c1/c6;
  Fn7    =          c2/c6;
  Fn8    =          c3/c6;
  Fn9    =          c4/c6;
  Fn10   =          c5/c6;
  Fn11   =          d1/d6;
  Fn12   =          d2/d6;
  Fn13   =          d3/d6;
  Fn14   =          d4/d6;
  Fn15   =          d5/d6;
-----
--

```

WALD procedure. Estimates and standard errors  
for nonlinear functions and joint test of

nonlinear restrictions.  
Wald Statistic = 238.24751  
Prob. from Chi-squared[15] = .00000  
Functions are computed at means of variables

```
-----+-----
```

WaldFcns	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Fncn(1)	-11.1404***	1.14443	-9.73	.0000	-13.3835	-8.8974
Fncn(2)	-13.5628***	1.43415	-9.46	.0000	-16.3737	-10.7519
Fncn(3)	-14.8081***	1.60367	-9.23	.0000	-17.9512	-11.6650
Fncn(4)	-10.7894***	1.07787	-10.01	.0000	-12.9020	-8.6768
Fncn(5)	-11.7852***	1.22204	-9.64	.0000	-14.1804	-9.3901
Fncn(6)	-7546.89	440167.3	-.02	.9863	-870258.94	855165.16
Fncn(7)	150.258	9307.858	.02	.9871	-18092.808	18393.324
Fncn(8)	460.310	27337.93	.02	.9866	-53121.040	54041.661
Fncn(9)	2167.31	127084.0	.02	.9864	-246912.78	251247.40
Fncn(10)	-319.375	18155.15	-.02	.9860	-35902.809	35264.059
Fncn(11)	-25.3162***	4.83873	-5.23	.0000	-34.8000	-15.8325
Fncn(12)	-2.98898	2.03316	-1.47	.1415	-6.97389	.99594
Fncn(13)	5.39795	3.81678	1.41	.1573	-2.08281	12.87871
Fncn(14)	14.9788**	6.13764	2.44	.0147	2.9493	27.0084
Fncn(15)	8.41343*	4.52285	1.86	.0629	-.45120	17.27805

```
-----+-----
```

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

```

|-> NLOGIT;
Lhs = choice, cset, alti;
Choices = a, b, c, d;
Model:
U(a)= csta*ATTB_A + cspb*ATTB_B +
cstc*ATTB_C + cstd*ATTB_D +
cste*ATTB_E + cstf*cost/
U(b)= csta*ATTB_A + cspb*ATTB_B +
cstc*ATTB_C + cstd*ATTB_D +
cste*ATTB_E + cstf*cost/
U(c)= csta*ATTB_A + cspb*ATTB_B +
cstc*ATTB_C + cstd*ATTB_D +
cste*ATTB_E + cstf*cost/
U(d)= ascd;
LCM= AGEPNTS;
parameters;
pts=3;
Pds = 8$;

```

Normal exit: 5 iterations. Status=0, F= 6169.598

```

-----+-----
Discrete choice (multinomial logit) model
Dependent variable Choice
Log likelihood function -6169.59788
Estimation based on N = 5168, K = 7
Inf.Cr.AIC = 12353.2 AIC/N = 2.390
Model estimated: Jul 02, 2020, 13:28:56
R2=1-LogL/LogL* Log-L fncn R-sqrd R2Adj
Constants only must be computed directly

```

```

Use NLOGIT ;...;RHS=ONE$
Response data are given as ind. choices
Number of obs.= 5168, skipped 0 obs

```

```

-----+-----
--

```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
CSTA 1	1.50800***	.08136	18.53	.0000	1.34853	1.66747
CSTB 1	.41312***	.08194	5.04	.0000	.25252	.57371
CSTC 1	.27535***	.07945	3.47	.0005	.11963	.43107
CSTD 1	-.12704	.08524	-1.49	.1361	-.29410	.04002
CSTE 1	.25096***	.08053	3.12	.0018	.09312	.40881
CSTF 1	-.03814***	.00830	-4.59	.0000	-.05442	-.02187
ASCD 1	.36529***	.12958	2.82	.0048	.11132	.61925

```

-----+-----
--

```

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

Line search at iteration 69 does not improve fn. Exiting optimization.

```

-----+-----
--
Latent Class Logit Model
Dependent variable          CHOICE
Log likelihood function     -5347.69785
Restricted log likelihood   -7164.36926
Chi squared [ 25 d.f.]     3633.34282
Significance level          .00000
McFadden Pseudo R-squared  .2535703
Estimation based on N = 5168, K = 25
Inf.Cr.AIC = 10745.4 AIC/N = 2.079
Model estimated: Jul 02, 2020, 13:29:03
Constants only must be computed directly
Use NLOGIT ;...;RHS=ONE$
At start values -6169.6289 .1332*****
Response data are given as ind. choices
Number of latent classes = 3
Average Class Probabilities
.311 .415 .275
LCM model with panel has 646 groups
Fixed number of obsrvs./group= 8
Number of obs.= 5168, skipped 0 obs

```

```

-----+-----
--

```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Utility parameters in latent class -->> 1						
CSTA 1	.81222***	.15578	5.21	.0000	.50690	1.11755
CSTB 1	.98754***	.15711	6.29	.0000	.67960	1.29547
CSTC 1	1.07763***	.16405	6.57	.0000	.75609	1.39916
CSTD 1	.78005***	.17437	4.47	.0000	.43830	1.12180
CSTE 1	.85382***	.15524	5.50	.0000	.54955	1.15808
CSTF 1	-.07256***	.01642	-4.42	.0000	-.10474	-.04038
ASCD 1	-.95908***	.30662	-3.13	.0018	-1.56004	-.35813
Utility parameters in latent class -->> 2						

```

CSTA|2| 2.55713*** .20994 12.18 .0000 2.14565 2.96861
CSTB|2| -.05898 .20169 -.29 .7700 -.45429 .33633
CSTC|2| -.16054 .17743 -.90 .3656 -.50829 .18722
CSTD|2| -.73530*** .20236 -3.63 .0003 -1.13191 -.33868
CSTE|2| .11209 .18832 .60 .5517 -.25700 .48118
CSTF|2| -.74880D-04 .01991 .00 .9970 -.39090D-01 .38941D-01
ASCD|2| -.65911* .34291 -1.92 .0546 -1.33121 .01299
|Utility parameters in latent class -->> 3
CSTA|3| 1.87176*** .19571 9.56 .0000 1.48818 2.25534
CSTB|3| .22450 .18756 1.20 .2313 -.14311 .59212
CSTC|3| -.39016** .19674 -1.98 .0474 -.77576 -.00455
CSTD|3| -1.09235*** .20641 -5.29 .0000 -1.49690 -.68779
CSTE|3| -.60942*** .19693 -3.09 .0020 -.99540 -.22343
CSTF|3| -.07319*** .01838 -3.98 .0001 -.10921 -.03717
ASCD|3| .89555*** .30745 2.91 .0036 .29296 1.49813
|This is THETA(01) in class probability model.
Constant| .15401 .11778 1.31 .1910 -.07683 .38485
_AGEPN|1| -28.0680 493635.7 .00 1.0000 *****
967480.0914
|This is THETA(02) in class probability model.
Constant| .43304*** .11691 3.70 .0002 .20391 .66217
_AGEPN|2| -1.21235 .86182 -1.41 .1595 -2.90149 .47679
|This is THETA(03) in class probability model.
Constant| 0.0 .....(Fixed Parameter).....
_AGEPN|3| 0.0 .....(Fixed Parameter).....
-----+-----
--

```

Note: nnnnn.D-xx or D+xx => multiply by 10 to -xx or +xx.  
Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.  
Fixed parameter ... is constrained to equal the value or  
had a nonpositive st.error because of an earlier problem.

```

|--
|->
|-> Wald;
Pts=1000;
Labels =
b1, b2, b3, b4, b5, b6, a1,
c1, c2, c3, c4, c5, c6, a2,
d1, d2, d3, d4, d5, d6, a3,
e1,e2,e3,e4,e5,e6;
Start = b;
Var = varb;
Fn1 = b1/b6;
Fn2 = b2/b6;
Fn3 = b3/b6;
Fn4 = b4/b6;
Fn5 = b5/b6;
Fn6 = c1/c6;
Fn7 = c2/c6;
Fn8 = c3/c6;
Fn9 = c4/c6;
Fn10 = c5/c6;
Fn11 = d1/d6;
Fn12 = d2/d6;
Fn13 = d3/d6;
Fn14 = d4/d6;
Fn15 = d5/d6$;

```

WALD procedure. Estimates and standard errors for nonlinear functions and joint test of nonlinear restrictions.

Wald Statistic = 237.17774  
 Prob. from Chi-squared[15] = .00000  
 Functions are computed at means of variables

WaldFcns	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Fncn(1)	-11.1936***	1.15951	-9.65	.0000	-13.4662	-8.9210
Fncn(2)	-13.6097***	1.45085	-9.38	.0000	-16.4533	-10.7660
Fncn(3)	-14.8512***	1.62256	-9.15	.0000	-18.0314	-11.6710
Fncn(4)	-10.7502***	1.06646	-10.08	.0000	-12.8405	-8.6600
Fncn(5)	-11.7668***	1.22059	-9.64	.0000	-14.1591	-9.3745
Fncn(6)	-34149.9	.9078D+07	.00	.9970	-17826526.8	17758227.1
Fncn(7)	787.690	211859.3	.00	.9970	-414448.861	416024.241
Fncn(8)	2143.92	572143.1	.00	.9970	-1119236.04	1123523.88
Fncn(9)	9819.72	.2613D+07	.00	.9970	-5112395.57	5132035.00
Fncn(10)	-1496.94	395774.0	.00	.9970	-777199.82	774205.94
Fncn(11)	-25.5731***	4.92077	-5.20	.0000	-35.2176	-15.9285
Fncn(12)	-3.06727	2.02320	-1.52	.1295	-7.03268	.89813
Fncn(13)	5.33056	3.80608	1.40	.1614	-2.12921	12.79033
Fncn(14)	14.9243**	6.13879	2.43	.0151	2.8925	26.9561
Fncn(15)	8.32618*	4.51923	1.84	.0654	-.53135	17.18371

Note: nnnnn.D-xx or D+xx => multiply by 10 to -xx or +xx.  
 Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

```

|-> NLOGIT;
  Lhs = choice, cset, alti;
  Choices = a, b, c, d;
  Model:
  U(a)= csta*ATTB_A + cstab*ATTB_B +
         cstc*ATTB_C + cstd*ATTB_D +
         cste*ATTB_E + cstf*cost/
  U(b)= csta*ATTB_A + cstab*ATTB_B +
         cstc*ATTB_C + cstd*ATTB_D +
         cste*ATTB_E + cstf*cost/
  U(c)= csta*ATTB_A + cstab*ATTB_B +
         cstc*ATTB_C + cstd*ATTB_D +
         cste*ATTB_E + cstf*cost/
  U(d)= ascd;
  LCM= AGE65;
  parameters;
  pts=3;
  Pds = 8$;
Normal exit: 5 iterations. Status=0, F= 6169.598

```

Discrete choice (multinomial logit) model  
 Dependent variable Choice  
 Log likelihood function -6169.59788

Estimation based on N = 5168, K = 7  
 Inf.Cr.AIC = 12353.2 AIC/N = 2.390  
 Model estimated: Jul 02, 2020, 13:29:04  
 R2=1-LogL/LogL\* Log-L fncn R-sqrd R2Adj  
 Constants only must be computed directly  
 Use NLOGIT ;...;RHS=ONE\$  
 Response data are given as ind. choices  
 Number of obs.= 5168, skipped 0 obs

```
-----+-----
```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
CSTA 1	1.50800***	.08136	18.53	.0000	1.34853	1.66747
CSTB 1	.41312***	.08194	5.04	.0000	.25252	.57371
CSTC 1	.27535***	.07945	3.47	.0005	.11963	.43107
CSTD 1	-.12704	.08524	-1.49	.1361	-.29410	.04002
CSTE 1	.25096***	.08053	3.12	.0018	.09312	.40881
CSTF 1	-.03814***	.00830	-4.59	.0000	-.05442	-.02187
ASCD 1	.36529***	.12958	2.82	.0048	.11132	.61925

```
-----+-----
```

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

Line search at iteration 50 does not improve fn. Exiting optimization.

```
-----+-----
```

Latent Class Logit Model  
 Dependent variable CHOICE  
 Log likelihood function -5350.40518  
 Restricted log likelihood -7164.36926  
 Chi squared [ 25 d.f.] 3627.92815  
 Significance level .00000  
 McFadden Pseudo R-squared .2531924  
 Estimation based on N = 5168, K = 25  
 Inf.Cr.AIC = 10750.8 AIC/N = 2.080  
 Model estimated: Jul 02, 2020, 13:29:10  
 Constants only must be computed directly  
 Use NLOGIT ;...;RHS=ONE\$  
 At start values -6169.6289 .1328\*\*\*\*\*  
 Response data are given as ind. choices  
 Number of latent classes = 3  
 Average Class Probabilities  
 .309 .415 .275  
 LCM model with panel has 646 groups  
 Fixed number of obsrvs./group= 8  
 Number of obs.= 5168, skipped 0 obs

```
-----+-----
```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Utility parameters in latent class -->> 1						
CSTA 1	.81531***	.15639	5.21	.0000	.50880	1.12183
CSTB 1	.99010***	.15732	6.29	.0000	.68177	1.29844
CSTC 1	1.08455***	.16430	6.60	.0000	.76254	1.40657



```

CSTD|1|      .79032***      .17486      4.52  .0000      .44760      1.13303
CSTE|1|      .86121***      .15560      5.53  .0000      .55623      1.16619
CSTF|1|     -.07303***      .01643     -4.44  .0000     -.10524     -.04082
ASCD|1|     -.96213***      .30765     -3.13  .0018     -1.56512     -.35914
  |Utility parameters in latent class --> 2
CSTA|2|     2.56148***      .20977     12.21  .0000      2.15033      2.97263
CSTB|2|     -.05127      .20166      -.25  .7993     -.44652      .34399
CSTC|2|     -.15789      .17704      -.89  .3725     -.50488      .18910
CSTD|2|     -.72900***      .20210     -3.61  .0003     -1.12511     -.33290
CSTE|2|     .11416      .18799      .61  .5437     -.25428      .48261
CSTF|2|     -.00055      .01988      -.03  .9781     -.03952      .03842
ASCD|2|     -.64887*      .34190     -1.90  .0577     -1.31898      .02123
  |Utility parameters in latent class --> 3
CSTA|3|     1.85768***      .19543      9.51  .0000      1.47464      2.24073
CSTB|3|     .22343      .18770      1.19  .2339     -.14446      .59131
CSTC|3|     -.38710**      .19666     -1.97  .0490     -.77255     -.00165
CSTD|3|     -1.09965***      .20635     -5.33  .0000     -1.50409     -.69520
CSTE|3|     -.61068***      .19624     -3.11  .0019     -.99531     -.22605
CSTF|3|     -.07308***      .01830     -3.99  .0001     -.10895     -.03722
ASCD|3|     .87943***      .30748      2.86  .0042      .27679      1.48207
  |This is THETA(01) in class probability model.
Constant|     .18355      .12575      1.46  .1444     -.06292      .43002
_AGE65|1|     -.60164      .36936     -1.63  .1033     -1.32557      .12228
  |This is THETA(02) in class probability model.
Constant|     .44873***      .12624      3.55  .0004      .20131      .69616
_AGE65|2|     -.30527      .32830     -.93  .3525     -.94874      .33819
  |This is THETA(03) in class probability model.
Constant|     0.0      .....(Fixed Parameter).....
_AGE65|3|     0.0      .....(Fixed Parameter).....
-----+-----
--

```

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.  
Fixed parameter ... is constrained to equal the value or  
had a nonpositive st.error because of an earlier problem.

--

```

|->
|-> Wald;
  Pts=1000;
  Labels =
  b1,    b2,        b3,        b4,        b5,        b6,        a1,
  c1,    c2,        c3,        c4,        c5,        c6,        a2,
  d1,    d2,        d3,        d4,        d5,        d6,        a3,
  e1,e2,e3,e4,e5,e6;
  Start  =          b;
  Var    =          varb;
  Fn1    =          b1/b6;
  Fn2    =          b2/b6;
  Fn3    =          b3/b6;
  Fn4    =          b4/b6;
  Fn5    =          b5/b6;
  Fn6    =          c1/c6;
  Fn7    =          c2/c6;
  Fn8    =          c3/c6;
  Fn9    =          c4/c6;
  Fn10   =          c5/c6;
  Fn11   =          d1/d6;
  Fn12   =          d2/d6;
  Fn13   =          d3/d6;
  Fn14   =          d4/d6;

```

Fn15 = d5/d6\$;

```
-----
--
WALD procedure. Estimates and standard errors
for nonlinear functions and joint test of
nonlinear restrictions.
Wald Statistic = 236.82914
Prob. from Chi-squared[15] = .00000
Functions are computed at means of variables
-----+
```

```
-----
--
```

WaldFcns	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Fncn(1)	-11.1639***	1.15746	-9.65	.0000	-13.4325	-8.8953
Fncn(2)	-13.5573***	1.43308	-9.46	.0000	-16.3660	-10.7485
Fncn(3)	-14.8505***	1.61433	-9.20	.0000	-18.0146	-11.6865
Fncn(4)	-10.8216***	1.07778	-10.04	.0000	-12.9340	-8.7092
Fncn(5)	-11.7924***	1.21756	-9.69	.0000	-14.1787	-9.4060
Fncn(6)	-4690.31	170457.1	-.03	.9780	-338780.08	329399.47
Fncn(7)	93.8753	3751.444	.03	.9800	-7258.8190	7446.5697
Fncn(8)	289.111	10813.02	.03	.9787	-20904.021	21482.242
Fncn(9)	1334.88	48934.89	.03	.9782	-94575.75	97245.51
Fncn(10)	-209.042	7304.032	-.03	.9772	-14524.683	14106.598
Fncn(11)	-25.4182***	4.86392	-5.23	.0000	-34.9513	-15.8851
Fncn(12)	-3.05711	2.03298	-1.50	.1326	-7.04167	.92745
Fncn(13)	5.29657	3.79807	1.39	.1632	-2.14751	12.74065
Fncn(14)	15.0462**	6.15626	2.44	.0145	2.9802	27.1122
Fncn(15)	8.35582*	4.51510	1.85	.0642	-.49362	17.20525

```
-----+
```

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

```
-----
--
|-> NLOGIT;
  lhs = choice, cset, alti;
  Choices = a, b, c, d;
  Model:
  U(a)= csta*ATTB_A + cstab*ATTB_B +
         cstc*ATTB_C + cstd*ATTB_D +
         cste*ATTB_E + cstf*cost/
  U(b)= csta*ATTB_A + cstab*ATTB_B +
         cstc*ATTB_C + cstd*ATTB_D +
         cste*ATTB_E + cstf*cost/
  U(c)= csta*ATTB_A + cstab*ATTB_B +
         cstc*ATTB_C + cstd*ATTB_D +
         cste*ATTB_E + cstf*cost/
  U(d)= ascd;
  LCM= AGE5564;
  parameters;
  pts=3;
  Pds = 8$;
Normal exit: 5 iterations. Status=0, F= 6169.598
-----
```

```
-----
--
Discrete choice (multinomial logit) model
Dependent variable Choice
```

```

Log likelihood function      -6169.59788
Estimation based on N =    5168, K =    7
Inf.Cr.AIC = 12353.2 AIC/N =    2.390
Model estimated: Jul 02, 2020, 13:29:11
R2=1-LogL/LogL* Log-L fncn R-sqrd R2Adj
Constants only must be computed directly
      Use NLOGIT ;...;RHS=ONE$
Response data are given as ind. choices
Number of obs.= 5168, skipped    0 obs

```

```

-----+-----
--

```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
CSTA 1	1.50800***	.08136	18.53	.0000	1.34853	1.66747
CSTB 1	.41312***	.08194	5.04	.0000	.25252	.57371
CSTC 1	.27535***	.07945	3.47	.0005	.11963	.43107
CSTD 1	-.12704	.08524	-1.49	.1361	-.29410	.04002
CSTE 1	.25096***	.08053	3.12	.0018	.09312	.40881
CSTF 1	-.03814***	.00830	-4.59	.0000	-.05442	-.02187
ASCD 1	.36529***	.12958	2.82	.0048	.11132	.61925

```

-----+-----
--

```

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

```

Normal exit: 52 iterations. Status=0, F= 5349.575

```

```

-----+-----
--
Latent Class Logit Model
Dependent variable          CHOICE
Log likelihood function     -5349.57490
Restricted log likelihood   -7164.36926
Chi squared [ 25 d.f.]     3629.58871
Significance level         .00000
McFadden Pseudo R-squared  .2533083
Estimation based on N =    5168, K =    25
Inf.Cr.AIC = 10749.1 AIC/N =    2.080
Model estimated: Jul 02, 2020, 13:29:17
Constants only must be computed directly
      Use NLOGIT ;...;RHS=ONE$
At start values -6169.6289 .1329*****
Response data are given as ind. choices
Number of latent classes =          3
Average Class Probabilities
      .310 .414 .276
LCM model with panel has    646 groups
Fixed number of obsrvs./group=    8
Number of obs.= 5168, skipped    0 obs

```

```

-----+-----
--

```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Utility parameters in latent class -->> 1						
CSTA 1	.81058***	.15589	5.20	.0000	.50505	1.11611
CSTB 1	.98730***	.15796	6.25	.0000	.67770	1.29690

```

CSTC|1| 1.07811*** .16408 6.57 .0000 .75652 1.39970
CSTD|1| .78080*** .17441 4.48 .0000 .43896 1.12264
CSTE|1| .85438*** .15525 5.50 .0000 .55010 1.15866
CSTF|1| -.07281*** .01642 -4.44 .0000 -.10499 -.04064
ASCD|1| -.95770*** .30655 -3.12 .0018 -1.55853 -.35687
|Utility parameters in latent class --> 2
CSTA|2| 2.55568*** .21062 12.13 .0000 2.14287 2.96850
CSTB|2| -.05750 .20233 -.28 .7763 -.45406 .33907
CSTC|2| -.15694 .17758 -.88 .3768 -.50499 .19111
CSTD|2| -.72907*** .20263 -3.60 .0003 -1.12621 -.33193
CSTE|2| .11352 .18842 .60 .5469 -.25578 .48282
CSTF|2| .00014 .01994 .01 .9944 -.03894 .03922
ASCD|2| -.66129* .34392 -1.92 .0545 -1.33536 .01278
|Utility parameters in latent class --> 3
CSTA|3| 1.86937*** .19520 9.58 .0000 1.48678 2.25197
CSTB|3| .21960 .18817 1.17 .2432 -.14920 .58840
CSTC|3| -.39952** .19954 -2.00 .0453 -.79061 -.00843
CSTD|3| -1.10740*** .20721 -5.34 .0000 -1.51352 -.70127
CSTE|3| -.61846*** .19615 -3.15 .0016 -1.00292 -.23401
CSTF|3| -.07227*** .01837 -3.94 .0001 -.10826 -.03627
ASCD|3| .88298*** .30748 2.87 .0041 .28032 1.48564
|This is THETA(01) in class probability model.
Constant| .24993* .13294 1.88 .0601 -.01063 .51048
_AGE55|1| -.53005** .26918 -1.97 .0489 -1.05764 -.00246
|This is THETA(02) in class probability model.
Constant| .50224*** .13006 3.86 .0001 .24733 .75715
_AGE55|2| -.35797 .24964 -1.43 .1516 -.84725 .13132
|This is THETA(03) in class probability model.
Constant| 0.0 .....(Fixed Parameter).....
_AGE55|3| 0.0 .....(Fixed Parameter).....

```

```

-----+
--
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
Fixed parameter ... is constrained to equal the value or
had a nonpositive st.error because of an earlier problem.
-----+
--

```

```

|->
|-> Wald;
Pts=1000;
Labels =
b1, b2, b3, b4, b5, b6, a1,
c1, c2, c3, c4, c5, c6, a2,
d1, d2, d3, d4, d5, d6, a3,
e1,e2,e3,e4,e5,e6;
Start = b;
Var = varb;
Fn1 = b1/b6;
Fn2 = b2/b6;
Fn3 = b3/b6;
Fn4 = b4/b6;
Fn5 = b5/b6;
Fn6 = c1/c6;
Fn7 = c2/c6;
Fn8 = c3/c6;
Fn9 = c4/c6;
Fn10 = c5/c6;
Fn11 = d1/d6;
Fn12 = d2/d6;
Fn13 = d3/d6;

```

```

Fn14 = d4/d6;
Fn15 = d5/d6$;

```

```

-----
--
WALD procedure. Estimates and standard errors
for nonlinear functions and joint test of
nonlinear restrictions.

```

```

Wald Statistic = 237.00837
Prob. from Chi-squared[15] = .00000
Functions are computed at means of variables
-----

```

WaldFcns	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Fncn(1)	-11.1321***	1.15195	-9.66	.0000	-13.3899	-8.8743
Fncn(2)	-13.5591***	1.44886	-9.36	.0000	-16.3988	-10.7194
Fncn(3)	-14.8063***	1.61216	-9.18	.0000	-17.9661	-11.6465
Fncn(4)	-10.7232***	1.06501	-10.07	.0000	-12.8106	-8.6358
Fncn(5)	-11.7336***	1.21753	-9.64	.0000	-14.1199	-9.3473
Fncn(6)	18222.9	.2592D+07	.01	.9944	-5061996.0	5098441.8
Fncn(7)	-409.977	56996.95	-.01	.9943	-112121.950	111301.996
Fncn(8)	-1119.05	157982.6	-.01	.9943	-310759.35	308521.25
Fncn(9)	-5198.53	737778.7	-.01	.9944	-1451218.14	1440821.08
Fncn(10)	809.428	116283.6	.01	.9944	-227102.197	228721.054
Fncn(11)	-25.8672***	5.05116	-5.12	.0000	-35.7673	-15.9671
Fncn(12)	-3.03865	2.05868	-1.48	.1399	-7.07359	.99628
Fncn(13)	5.52826	3.93593	1.40	.1602	-2.18603	13.24254
Fncn(14)	15.3234**	6.32685	2.42	.0154	2.9231	27.7238
Fncn(15)	8.55789*	4.62063	1.85	.0640	-.49837	17.61415

```

-----
--
Note: nnnnn.D-xx or D+xx => multiply by 10 to -xx or +xx.
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
-----

```

```

|-> NLOGIT;
Lhs = choice, cset, alti;
Choices = a, b, c, d;
Model:
U(a)= csta*ATTB_A + cstb*ATTB_B +
      cstc*ATTB_C + cstd*ATTB_D +
      cste*ATTB_E + cstf*cost/
U(b)= csta*ATTB_A + cstb*ATTB_B +
      cstc*ATTB_C + cstd*ATTB_D +
      cste*ATTB_E + cstf*cost/
U(c)= csta*ATTB_A + cstb*ATTB_B +
      cstc*ATTB_C + cstd*ATTB_D +
      cste*ATTB_E + cstf*cost/
U(d)= ascd;
LCM= AGE4554;
parameters;
pts=3;
Pds = 8$;
Normal exit: 5 iterations. Status=0, F= 6169.598
-----

```

Discrete choice (multinomial logit) model  
 Dependent variable Choice  
 Log likelihood function -6169.59788  
 Estimation based on N = 5168, K = 7  
 Inf.Cr.AIC = 12353.2 AIC/N = 2.390  
 Model estimated: Jul 02, 2020, 13:29:18  
 R2=1-LogL/LogL\* Log-L fncn R-sqrd R2Adj  
 Constants only must be computed directly  
 Use NLOGIT ;...;RHS=ONE\$  
 Response data are given as ind. choices  
 Number of obs.= 5168, skipped 0 obs

```
-----+-----
```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
CSTA 1	1.50800***	.08136	18.53	.0000	1.34853	1.66747
CSTB 1	.41312***	.08194	5.04	.0000	.25252	.57371
CSTC 1	.27535***	.07945	3.47	.0005	.11963	.43107
CSTD 1	-.12704	.08524	-1.49	.1361	-.29410	.04002
CSTE 1	.25096***	.08053	3.12	.0018	.09312	.40881
CSTF 1	-.03814***	.00830	-4.59	.0000	-.05442	-.02187
ASCD 1	.36529***	.12958	2.82	.0048	.11132	.61925

```
-----+-----
```

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

Line search at iteration 52 does not improve fn. Exiting optimization.

```
-----+-----
```

Latent Class Logit Model  
 Dependent variable CHOICE  
 Log likelihood function -5350.82465  
 Restricted log likelihood -7164.36926  
 Chi squared [ 25 d.f.] 3627.08922  
 Significance level .00000  
 McFadden Pseudo R-squared .2531339  
 Estimation based on N = 5168, K = 25  
 Inf.Cr.AIC = 10751.6 AIC/N = 2.080  
 Model estimated: Jul 02, 2020, 13:29:25  
 Constants only must be computed directly  
 Use NLOGIT ;...;RHS=ONE\$  
 At start values -6169.6289 .1327\*\*\*\*\*  
 Response data are given as ind. choices  
 Number of latent classes = 3  
 Average Class Probabilities  
 .309 .415 .275  
 LCM model with panel has 646 groups  
 Fixed number of obsrvs./group= 8  
 Number of obs.= 5168, skipped 0 obs

```
-----+-----
```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
--------	-------------	----------------	---	--------------	-------------------------	--

```
-----+-----
```

|Utility parameters in latent class -->> 1

```

CSTA|1|      .81051***      .15649      5.18      .0000      .50380      1.11722
CSTB|1|      .99009***      .15750      6.29      .0000      .68140      1.29878
CSTC|1|      1.08126***      .16485      6.56      .0000      .75817      1.40436
CSTD|1|      .78423***      .17577      4.46      .0000      .43972      1.12873
CSTE|1|      .85731***      .15572      5.51      .0000      .55211      1.16250
CSTF|1|     -.07268***      .01648      -4.41     .0000      -.10498     -.04038
ASCD|1|     -.95591***      .30713      -3.11     .0019     -1.55787     -.35396
|Utility parameters in latent class --> 2
CSTA|2|      2.55511***      .20946      12.20     .0000      2.14457      2.96565
CSTB|2|     -.05788      .20115      -0.29     .7735     -.45214      .33637
CSTC|2|     -.15782      .17706      -0.89     .3727     -.50485      .18920
CSTD|2|     -.72974***      .20193      -3.61     .0003     -1.12553     -.33396
CSTE|2|      .11455      .18786      .61      .5420     -.25365      .48275
CSTF|2|     -.00013      .01986      -0.01     .9948     -.03905      .03879
ASCD|2|     -.65740*      .34233      -1.92     .0548     -1.32836      .01355
|Utility parameters in latent class --> 3
CSTA|3|      1.86450***      .19543      9.54      .0000      1.48147      2.24754
CSTB|3|      .22243      .18726      1.19     .2349     -.14459      .58946
CSTC|3|     -.39143**      .19644      -1.99     .0463     -.77644     -.00642
CSTD|3|     -1.10073***      .20587      -5.35     .0000     -1.50422     -.69723
CSTE|3|     -.61382***      .19611      -3.13     .0017     -.99820     -.22944
CSTF|3|     -.07342***      .01828      -4.02     .0001     -.10924     -.03760
ASCD|3|      .87864***      .30683      2.86      .0042      .27727      1.48002
|This is THETA(01) in class probability model.
Constant|      .03526      .13449      .26      .7932     -.22833      .29885
_AGE45|1|      .35885      .27185      1.32     .1868     -.17396      .89166
|This is THETA(02) in class probability model.
Constant|      .34802***      .13045      2.67     .0076      .09235      .60368
_AGE45|2|      .28573      .26163      1.09     .2748     -.22705      .79851
|This is THETA(03) in class probability model.
Constant|      0.0      ..... (Fixed Parameter) .....
_AGE45|3|      0.0      ..... (Fixed Parameter) .....

```

```

-----
--
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
Fixed parameter ... is constrained to equal the value or
had a nonpositive st.error because of an earlier problem.
-----
--

```

```

|->
|-> Wald;
    Pts=1000;
    Labels =
    b1,    b2,    b3,    b4,    b5,    b6,    a1,
    c1,    c2,    c3,    c4,    c5,    c6,    a2,
    d1,    d2,    d3,    d4,    d5,    d6,    a3,
    e1,e2,e3,e4,e5,e6;
    Start =      b;
    Var    =      varb;
    Fn1    =      b1/b6;
    Fn2    =      b2/b6;
    Fn3    =      b3/b6;
    Fn4    =      b4/b6;
    Fn5    =      b5/b6;
    Fn6    =      c1/c6;
    Fn7    =      c2/c6;
    Fn8    =      c3/c6;
    Fn9    =      c4/c6;
    Fn10   =      c5/c6;
    Fn11   =      d1/d6;

```

```

Fn12 = d2/d6;
Fn13 = d3/d6;
Fn14 = d4/d6;
Fn15 = d5/d6$;

```

```

-----
--
WALD procedure. Estimates and standard errors
for nonlinear functions and joint test of
nonlinear restrictions.
Wald Statistic = 237.39972
Prob. from Chi-squared[15] = .00000
Functions are computed at means of variables
-----

```

WaldFcns	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Fncn(1)	-11.1518***	1.15365	-9.67	.0000	-13.4129	-8.8907
Fncn(2)	-13.6226***	1.46230	-9.32	.0000	-16.4887	-10.7566
Fncn(3)	-14.8771***	1.62852	-9.14	.0000	-18.0689	-11.6852
Fncn(4)	-10.7902***	1.07376	-10.05	.0000	-12.8947	-8.6856
Fncn(5)	-11.7957***	1.22631	-9.62	.0000	-14.1992	-9.3921
Fncn(6)	-19856.0	.3063D+07	-.01	.9948	-6022774.2	5983062.3
Fncn(7)	449.825	70820.21	.01	.9949	-138355.227	139254.877
Fncn(8)	1226.45	190474.9	.01	.9949	-372097.49	374550.39
Fncn(9)	5670.91	876527.1	.01	.9948	-1712290.72	1723632.54
Fncn(10)	-890.191	136062.7	-.01	.9948	-267568.142	265787.759
Fncn(11)	-25.3958***	4.83738	-5.25	.0000	-34.8769	-15.9148
Fncn(12)	-3.02970	2.02230	-1.50	.1341	-6.99334	.93393
Fncn(13)	5.33158	3.78295	1.41	.1587	-2.08286	12.74602
Fncn(14)	14.9927**	6.11264	2.45	.0142	3.0121	26.9732
Fncn(15)	8.36063*	4.49215	1.86	.0627	-.44383	17.16509

```

-----
--
Note: nnnnn.D-xx or D+xx => multiply by 10 to -xx or +xx.
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
-----

```

```

--
|-> NLOGIT;
Lhs = choice, cset, alti;
Choices = a, b, c, d;
Model:
U(a)= csta*ATTB_A + cspb*ATTB_B +
cstc*ATTB_C + cstd*ATTB_D +
cste*ATTB_E + cstf*cost/
U(b)= csta*ATTB_A + cspb*ATTB_B +
cstc*ATTB_C + cstd*ATTB_D +
cste*ATTB_E + cstf*cost/
U(c)= csta*ATTB_A + cspb*ATTB_B +
cstc*ATTB_C + cstd*ATTB_D +
cste*ATTB_E + cstf*cost/
U(d)= ascd;
LCM= AGE3544;
parameters;
pts=3;
Pds = 8$;
Normal exit: 5 iterations. Status=0, F= 6169.598

```



```

-----
--
Discrete choice (multinomial logit) model
Dependent variable          Choice
Log likelihood function     -6169.59788
Estimation based on N =    5168, K =    7
Inf.Cr.AIC = 12353.2 AIC/N =    2.390
Model estimated: Jul 02, 2020, 13:29:25
R2=1-LogL/LogL* Log-L fncn R-sqrd R2Adj
Constants only must be computed directly
      Use NLOGIT ;...;RHS=ONE$
Response data are given as ind. choices
Number of obs.= 5168, skipped    0 obs
-----

```

```

-----
--

```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
CSTA 1	1.50800***	.08136	18.53	.0000	1.34853	1.66747
CSTB 1	.41312***	.08194	5.04	.0000	.25252	.57371
CSTC 1	.27535***	.07945	3.47	.0005	.11963	.43107
CSTD 1	-.12704	.08524	-1.49	.1361	-.29410	.04002
CSTE 1	.25096***	.08053	3.12	.0018	.09312	.40881
CSTF 1	-.03814***	.00830	-4.59	.0000	-.05442	-.02187
ASCD 1	.36529***	.12958	2.82	.0048	.11132	.61925

```

-----

```

```

--
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
-----

```

```

--
Normal exit: 52 iterations. Status=0, F= 5348.453
-----

```

```

-----
--
Latent Class Logit Model
Dependent variable          CHOICE
Log likelihood function     -5348.45286
Restricted log likelihood   -7164.36926
Chi squared [ 25 d.f.]     3631.83280
Significance level         .00000
McFadden Pseudo R-squared .2534649
Estimation based on N =    5168, K =    25
Inf.Cr.AIC = 10746.9 AIC/N =    2.080
Model estimated: Jul 02, 2020, 13:29:31
Constants only must be computed directly
      Use NLOGIT ;...;RHS=ONE$
At start values -6169.6289 .1331*****
Response data are given as ind. choices
Number of latent classes =    3
Average Class Probabilities
      .310 .417 .273
LCM model with panel has    646 groups
Fixed number of obsrvs./group=    8
Number of obs.= 5168, skipped    0 obs
-----

```

```

-----
--

```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
--------	-------------	----------------	---	--------------	-------------------------	--

```

-----+-----
--
      |Utility parameters in latent class -->> 1
CSTA|1|   .81022***   .15577   5.20   .0000   .50491   1.11553
CSTB|1|   .98840***   .15754   6.27   .0000   .67962   1.29718
CSTC|1|   1.07693***   .16407   6.56   .0000   .75536   1.39850
CSTD|1|   .77906***   .17432   4.47   .0000   .43740   1.12072
CSTE|1|   .85282***   .15542   5.49   .0000   .54819   1.15744
CSTF|1|  -.07234***   .01642   -4.41   .0000   -.10452   -.04016
ASCD|1|  -.96662***   .30803   -3.14   .0017   -1.57035   -.36289
      |Utility parameters in latent class -->> 2
CSTA|2|   2.57372***   .20924   12.30   .0000   2.16361   2.98383
CSTB|2|  -.04137   .20140   -.21   .8373   -.43611   .35337
CSTC|2|  -.14250   .17724   -.80   .4214   -.48987   .20488
CSTD|2|  -.71226***   .20180   -3.53   .0004   -1.10778   -.31674
CSTE|2|   .13051   .18775   .70   .4870   -.23748   .49849
CSTF|2|  -.00262   .01997   -.13   .8957   -.04175   .03651
ASCD|2|  -.61176*   .34231   -1.79   .0739   -1.28268   .05916
      |Utility parameters in latent class -->> 3
CSTA|3|   1.85042***   .19864   9.32   .0000   1.46110   2.23974
CSTB|3|   .21495   .18916   1.14   .2558   -.15579   .58570
CSTC|3|  -.40207**   .19970   -2.01   .0441   -.79347   -.01066
CSTD|3|  -1.11064***   .21080   -5.27   .0000   -1.52380   -.69749
CSTE|3|  -.62306***   .19804   -3.15   .0017   -1.01122   -.23491
CSTF|3|  -.07226***   .01855   -3.90   .0001   -.10861   -.03590
ASCD|3|   .87229***   .31052   2.81   .0050   .26369   1.48089
      |This is THETA(01) in class probability model.
Constant|   .04971   .13229   .38   .7071   -.20958   .30900
_AGE35|1|   .42092   .30507   1.38   .1677   -.17700   1.01885
      |This is THETA(02) in class probability model.
Constant|   .27881**   .13230   2.11   .0351   .01950   .53812
_AGE35|2|   .69842***   .29245   2.39   .0169   .12523   1.27161
      |This is THETA(03) in class probability model.
Constant|   0.0   .....(Fixed Parameter).....
_AGE35|3|   0.0   .....(Fixed Parameter).....
-----+-----
--
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
Fixed parameter ... is constrained to equal the value or
had a nonpositive st.error because of an earlier problem.
-----+-----
--
|->
|-> Wald;
    Pts=1000;
    Labels =
    b1,   b2,   b3,   b4,   b5,   b6,   a1,
    c1,   c2,   c3,   c4,   c5,   c6,   a2,
    d1,   d2,   d3,   d4,   d5,   d6,   a3,
    e1,e2,e3,e4,e5,e6;
    Start =   b;
    Var    =   varb;
    Fn1   =   b1/b6;
    Fn2   =   b2/b6;
    Fn3   =   b3/b6;
    Fn4   =   b4/b6;
    Fn5   =   b5/b6;
    Fn6   =   c1/c6;
    Fn7   =   c2/c6;
    Fn8   =   c3/c6;

```

```

Fn9    =      c4/c6;
Fn10   =      c5/c6;
Fn11   =      d1/d6;
Fn12   =      d2/d6;
Fn13   =      d3/d6;
Fn14   =      d4/d6;
Fn15   =      d5/d6$;

```

```

-----
--
WALD procedure. Estimates and standard errors
for nonlinear functions and joint test of
nonlinear restrictions.

```

```

Wald Statistic      =      233.60126
Prob. from Chi-squared[15] =      .00000
Functions are computed at means of variables
-----

```

```

-----
--

```

WaldFcns	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Fncn(1)	-11.2000***	1.16250	-9.63	.0000	-13.4784	-8.9215
Fncn(2)	-13.6631***	1.46813	-9.31	.0000	-16.5405	-10.7856
Fncn(3)	-14.8869***	1.63970	-9.08	.0000	-18.1006	-11.6731
Fncn(4)	-10.7692***	1.07468	-10.02	.0000	-12.8756	-8.6629
Fncn(5)	-11.7889***	1.23076	-9.58	.0000	-14.2011	-9.3766
Fncn(6)	-983.125	7434.846	-.13	.8948	-15555.155	13588.906
Fncn(7)	15.8014	192.4526	.08	.9346	-361.3987	393.0015
Fncn(8)	54.4314	476.0604	.11	.9090	-878.6298	987.4925
Fncn(9)	272.075	2145.364	.13	.8991	-3932.760	4476.910
Fncn(10)	-49.8518	317.6045	-.16	.8753	-672.3452	572.6415
Fncn(11)	-25.6091***	5.03089	-5.09	.0000	-35.4694	-15.7487
Fncn(12)	-2.97486	2.08130	-1.43	.1529	-7.05413	1.10440
Fncn(13)	5.56448	3.95916	1.41	.1599	-2.19534	13.32430
Fncn(14)	15.3709**	6.41708	2.40	.0166	2.7936	27.9481
Fncn(15)	8.62295*	4.68022	1.84	.0654	-.55012	17.79602

```

-----
--

```

```

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
-----
--

```

```

|-> NLOGIT;
Lhs      =      choice,      cset,      alti;
Choices  =      a,          b,          c,          d;
Model:
U(a)=  csta*ATTB_A      +      cstab*ATTB_B      +
      cstc*ATTB_C      +      cstd*ATTB_D      +
      cste*ATTB_E      +      cstf*cost/
U(b)=  csta*ATTB_A      +      cstab*ATTB_B      +
      cstc*ATTB_C      +      cstd*ATTB_D      +
      cste*ATTB_E      +      cstf*cost/
U(c)=  csta*ATTB_A      +      cstab*ATTB_B      +
      cstc*ATTB_C      +      cstd*ATTB_D      +
      cste*ATTB_E      +      cstf*cost/
U(d)=  ascd;
LCM= AGE2534;
parameters;
pts=3;
Pds      =      8$;

```

Normal exit: 5 iterations. Status=0, F= 6169.598

-----  
--  
Discrete choice (multinomial logit) model  
Dependent variable Choice  
Log likelihood function -6169.59788  
Estimation based on N = 5168, K = 7  
Inf.Cr.AIC = 12353.2 AIC/N = 2.390  
Model estimated: Jul 02, 2020, 13:29:32  
R2=1-LogL/LogL\* Log-L fncn R-sqrd R2Adj  
Constants only must be computed directly  
Use NLOGIT ;...;RHS=ONE\$  
Response data are given as ind. choices  
Number of obs.= 5168, skipped 0 obs  
-----+

-----  
--

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
CSTA 1	1.50800***	.08136	18.53	.0000	1.34853	1.66747
CSTB 1	.41312***	.08194	5.04	.0000	.25252	.57371
CSTC 1	.27535***	.07945	3.47	.0005	.11963	.43107
CSTD 1	-.12704	.08524	-1.49	.1361	-.29410	.04002
CSTE 1	.25096***	.08053	3.12	.0018	.09312	.40881
CSTF 1	-.03814***	.00830	-4.59	.0000	-.05442	-.02187
ASCD 1	.36529***	.12958	2.82	.0048	.11132	.61925

-----+

-----  
--  
Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.  
-----

-----  
--  
Line search at iteration 54 does not improve fn. Exiting optimization.  
-----

-----  
--  
Latent Class Logit Model  
Dependent variable CHOICE  
Log likelihood function -5348.96218  
Restricted log likelihood -7164.36926  
Chi squared [ 25 d.f.] 3630.81415  
Significance level .00000  
McFadden Pseudo R-squared .2533938  
Estimation based on N = 5168, K = 25  
Inf.Cr.AIC = 10747.9 AIC/N = 2.080  
Model estimated: Jul 02, 2020, 13:29:39  
Constants only must be computed directly  
Use NLOGIT ;...;RHS=ONE\$  
At start values -6169.6289 .1330\*\*\*\*\*  
Response data are given as ind. choices  
Number of latent classes = 3  
Average Class Probabilities  
.315 .410 .275  
LCM model with panel has 646 groups  
Fixed number of obsrvs./group= 8  
Number of obs.= 5168, skipped 0 obs  
-----+

-----  
--  
| Standard Prob. 95% Confidence

CHOICE	Coefficient	Error	z	z >Z*	Interval	
-----+-----						
--						
Utility parameters in latent class -->> 1						
CSTA 1	.81491***	.15519	5.25	.0000	.51075	1.11907
CSTB 1	.97385***	.15630	6.23	.0000	.66750	1.28019
CSTC 1	1.06119***	.16413	6.47	.0000	.73951	1.38287
CSTD 1	.76225***	.17527	4.35	.0000	.41873	1.10576
CSTE 1	.84384***	.15410	5.48	.0000	.54180	1.14587
CSTF 1	-.07214***	.01647	-4.38	.0000	-.10443	-.03985
ASCD 1	-.98954***	.30471	-3.25	.0012	-1.58675	-.39232
Utility parameters in latent class -->> 2						
CSTA 2	2.58749***	.21843	11.85	.0000	2.15939	3.01560
CSTB 2	-.05639	.20410	-.28	.7823	-.45642	.34365
CSTC 2	-.16094	.17924	-.90	.3692	-.51224	.19036
CSTD 2	-.73259***	.20715	-3.54	.0004	-1.13860	-.32657
CSTE 2	.11003	.19097	.58	.5645	-.26427	.48432
CSTF 2	.00033	.02012	.02	.9869	-.03911	.03977
ASCD 2	-.61788*	.35379	-1.75	.0807	-1.31131	.07554
Utility parameters in latent class -->> 3						
CSTA 3	1.87366***	.19603	9.56	.0000	1.48945	2.25786
CSTB 3	.22587	.18761	1.20	.2286	-.14183	.59357
CSTC 3	-.39115**	.19692	-1.99	.0470	-.77709	-.00520
CSTD 3	-1.09994***	.20720	-5.31	.0000	-1.50605	-.69382
CSTE 3	-.61144***	.19601	-3.12	.0018	-.99561	-.22727
CSTF 3	-.07263***	.01852	-3.92	.0001	-.10893	-.03632
ASCD 3	.89956***	.30974	2.90	.0037	.29249	1.50664
This is THETA(01) in class probability model.						
Constant	.04246	.12517	.34	.7345	-.20288	.28779
_AGE25 1	.84134**	.40691	2.07	.0387	.04381	1.63887
This is THETA(02) in class probability model.						
Constant	.37945***	.12543	3.03	.0025	.13360	.62529
_AGE25 2	.26479	.43597	.61	.5436	-.58969	1.11927
This is THETA(03) in class probability model.						
Constant	0.0	.....(Fixed Parameter).....				
_AGE25 3	0.0	.....(Fixed Parameter).....				
-----+-----						

--

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.  
Fixed parameter ... is constrained to equal the value or  
had a nonpositive st.error because of an earlier problem.

-----+-----

--

```

|->
|-> Wald;
    Pts=1000;
    Labels =
    b1,    b2,    b3,    b4,    b5,    b6,    a1,
    c1,    c2,    c3,    c4,    c5,    c6,    a2,
    d1,    d2,    d3,    d4,    d5,    d6,    a3,
    e1,e2,e3,e4,e5,e6;
    Start =          b;
    Var    =          varb;
    Fn1    =          b1/b6;
    Fn2    =          b2/b6;
    Fn3    =          b3/b6;
    Fn4    =          b4/b6;
    Fn5    =          b5/b6;
    Fn6    =          c1/c6;
    Fn7    =          c2/c6;

```

```

Fn8    =      c3/c6;
Fn9    =      c4/c6;
Fn10   =      c5/c6;
Fn11   =      d1/d6;
Fn12   =      d2/d6;
Fn13   =      d3/d6;
Fn14   =      d4/d6;
Fn15   =      d5/d6$;

```

```

-----
--
WALD procedure. Estimates and standard errors
for nonlinear functions and joint test of
nonlinear restrictions.

```

```

Wald Statistic      =      230.71495
Prob. from Chi-squared[15] =      .00000
Functions are computed at means of variables
-----

```

```

-----
--

```

WaldFcns	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Fncn(1)	-11.2966***	1.18768	-9.51	.0000	-13.6244	-8.9688
Fncn(2)	-13.4998***	1.45159	-9.30	.0000	-16.3449	-10.6547
Fncn(3)	-14.7106***	1.60933	-9.14	.0000	-17.8649	-11.5564
Fncn(4)	-10.5665***	1.08110	-9.77	.0000	-12.6854	-8.4476
Fncn(5)	-11.6975***	1.25181	-9.34	.0000	-14.1510	-9.2440
Fncn(6)	7844.94	479151.3	.02	.9869	-931274.27	946964.15
Fncn(7)	-170.954	9879.351	-.02	.9862	-19534.127	19192.218
Fncn(8)	-487.948	29291.93	-.02	.9867	-57899.083	56923.186
Fncn(9)	-2221.10	134947.2	-.02	.9869	-266712.85	262270.64
Fncn(10)	333.585	20872.55	.02	.9872	-40575.867	41243.037
Fncn(11)	-25.7986***	5.10386	-5.05	.0000	-35.8019	-15.7952
Fncn(12)	-3.11000	2.04809	-1.52	.1289	-7.12418	.90418
Fncn(13)	5.38573	3.86115	1.39	.1631	-2.18199	12.95345
Fncn(14)	15.1451**	6.28285	2.41	.0159	2.8310	27.4593
Fncn(15)	8.41895*	4.57140	1.84	.0655	-.54082	17.37872

```

-----
--

```

```

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
-----
--

```

```

|-> NLOGIT;
Lhs      =      choice,      cset,      alti;
Choices  =      a,          b,          c,          d;
Model:
U(a)=  csta*ATTB_A      +      cstab*ATTB_B      +
      cstc*ATTB_C      +      cstd*ATTB_D      +
      cste*ATTB_E      +      cstf*cost/
U(b)=  csta*ATTB_A      +      cstab*ATTB_B      +
      cstc*ATTB_C      +      cstd*ATTB_D      +
      cste*ATTB_E      +      cstf*cost/
U(c)=  csta*ATTB_A      +      cstab*ATTB_B      +
      cstc*ATTB_C      +      cstd*ATTB_D      +
      cste*ATTB_E      +      cstf*cost/
U(d)=  ascd;
LCM= AGE1824;
parameters;
pts=3;

```

Pds = 8\$;  
 Normal exit: 5 iterations. Status=0, F= 6169.598

```
-----
--
Discrete choice (multinomial logit) model
Dependent variable      Choice
Log likelihood function -6169.59788
Estimation based on N = 5168, K = 7
Inf.Cr.AIC = 12353.2 AIC/N = 2.390
Model estimated: Jul 02, 2020, 13:29:40
R2=1-LogL/LogL* Log-L fncn R-sqrd R2Adj
Constants only must be computed directly
      Use NLOGIT ;...;RHS=ONE$
Response data are given as ind. choices
Number of obs.= 5168, skipped 0 obs
-----
+
```

```
-----
--
```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
CSTA 1	1.50800***	.08136	18.53	.0000	1.34853	1.66747
CSTB 1	.41312***	.08194	5.04	.0000	.25252	.57371
CSTC 1	.27535***	.07945	3.47	.0005	.11963	.43107
CSTD 1	-.12704	.08524	-1.49	.1361	-.29410	.04002
CSTE 1	.25096***	.08053	3.12	.0018	.09312	.40881
CSTF 1	-.03814***	.00830	-4.59	.0000	-.05442	-.02187
ASCD 1	.36529***	.12958	2.82	.0048	.11132	.61925

```
-----
+
```

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

Normal exit: 56 iterations. Status=0, F= 5350.869

```
-----
--
Latent Class Logit Model
Dependent variable      CHOICE
Log likelihood function -5350.86929
Restricted log likelihood -7164.36926
Chi squared [ 25 d.f.] 3626.99993
Significance level      .00000
McFadden Pseudo R-squared .2531277
Estimation based on N = 5168, K = 25
Inf.Cr.AIC = 10751.7 AIC/N = 2.080
Model estimated: Jul 02, 2020, 13:29:46
Constants only must be computed directly
      Use NLOGIT ;...;RHS=ONE$
At start values -6169.6289 .1327*****
Response data are given as ind. choices
Number of latent classes = 3
Average Class Probabilities
      .314 .412 .274
LCM model with panel has 646 groups
Fixed number of obsrvs./group= 8
Number of obs.= 5168, skipped 0 obs
-----
+
```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
-----+-----						
--						
Utility parameters in latent class --> 1						
CSTA 1	.81562***	.15525	5.25	.0000	.51135	1.11990
CSTB 1	.97628***	.15766	6.19	.0000	.66728	1.28529
CSTC 1	1.07636***	.16365	6.58	.0000	.75562	1.39710
CSTD 1	.76636***	.17486	4.38	.0000	.42363	1.10908
CSTE 1	.85057***	.15463	5.50	.0000	.54750	1.15364
CSTF 1	-.07186***	.01639	-4.39	.0000	-.10398	-.03974
ASCD 1	-.96305***	.30551	-3.15	.0016	-1.56184	-.36425
Utility parameters in latent class --> 2						
CSTA 2	2.59135***	.21274	12.18	.0000	2.17438	3.00832
CSTB 2	-.03410	.20249	-.17	.8663	-.43097	.36278
CSTC 2	-.16285	.17793	-.92	.3601	-.51159	.18589
CSTD 2	-.71425***	.20346	-3.51	.0004	-1.11304	-.31547
CSTE 2	.12034	.18916	.64	.5247	-.25042	.49109
CSTF 2	-.00199	.01999	-.10	.9206	-.04116	.03718
ASCD 2	-.61722*	.34474	-1.79	.0734	-1.29291	.05846
Utility parameters in latent class --> 3						
CSTA 3	1.86274***	.19620	9.49	.0000	1.47821	2.24728
CSTB 3	.22025	.18739	1.18	.2399	-.14704	.58754
CSTC 3	-.39138**	.19690	-1.99	.0468	-.77730	-.00547
CSTD 3	-1.10185***	.20720	-5.32	.0000	-1.50796	-.69573
CSTE 3	-.61307***	.19717	-3.11	.0019	-.99952	-.22662
CSTF 3	-.07325***	.01835	-3.99	.0001	-.10922	-.03729
ASCD 3	.88160***	.30757	2.87	.0042	.27878	1.48442
This is THETA(01) in class probability model.						
Constant	.12564	.11952	1.05	.2932	-.10862	.35990
_AGE18 1	.36360	.85115	.43	.6692	-1.30463	2.03182
This is THETA(02) in class probability model.						
Constant	.41960***	.11751	3.57	.0004	.18927	.64992
_AGE18 2	-1.51918	1.79269	-.85	.3968	-5.03278	1.99442
This is THETA(03) in class probability model.						
Constant	0.0	.....(Fixed Parameter).....				
_AGE18 3	0.0	.....(Fixed Parameter).....				
-----+-----						

--

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.  
Fixed parameter ... is constrained to equal the value or  
had a nonpositive st.error because of an earlier problem.

-----+-----

--

```

|->
|-> Wald;
    Pts=1000;
    Labels =
    b1,    b2,    b3,    b4,    b5,    b6,    a1,
    c1,    c2,    c3,    c4,    c5,    c6,    a2,
    d1,    d2,    d3,    d4,    d5,    d6,    a3,
    e1,e2,e3,e4,e5,e6;
    Start =          b;
    Var    =          varb;
    Fn1    =          b1/b6;
    Fn2    =          b2/b6;
    Fn3    =          b3/b6;
    Fn4    =          b4/b6;
    Fn5    =          b5/b6;
    Fn6    =          c1/c6;

```



```

Fn7   =      c2/c6;
Fn8   =      c3/c6;
Fn9   =      c4/c6;
Fn10  =      c5/c6;
Fn11  =      d1/d6;
Fn12  =      d2/d6;
Fn13  =      d3/d6;
Fn14  =      d4/d6;
Fn15  =      d5/d6$;

```

```

-----
--
WALD procedure. Estimates and standard errors
for nonlinear functions and joint test of
nonlinear restrictions.
Wald Statistic           =      236.86956
Prob. from Chi-squared[15] =      .00000
Functions are computed at means of variables
-----

```

```

-----
--

```

WaldFcns	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Fncn(1)	-11.3499***	1.19187	-9.52	.0000	-13.6859	-9.0139
Fncn(2)	-13.5856***	1.45398	-9.34	.0000	-16.4354	-10.7359
Fncn(3)	-14.9783***	1.65700	-9.04	.0000	-18.2260	-11.7306
Fncn(4)	-10.6644***	1.07363	-9.93	.0000	-12.7686	-8.5601
Fncn(5)	-11.8362***	1.23848	-9.56	.0000	-14.2636	-9.4089
Fncn(6)	-1301.23	12975.73	-.10	.9201	-26733.19	24130.74
Fncn(7)	17.1217	266.8382	.06	.9488	-505.8715	540.1149
Fncn(8)	81.7732	900.5891	.09	.9277	-1683.3491	1846.8955
Fncn(9)	358.656	3692.598	.10	.9226	-6878.703	7596.015
Fncn(10)	-60.4265	523.1416	-.12	.9080	-1085.7652	964.9123
Fncn(11)	-25.4283***	4.87972	-5.21	.0000	-34.9924	-15.8643
Fncn(12)	-3.00665	2.02992	-1.48	.1386	-6.98523	.97192
Fncn(13)	5.34280	3.80582	1.40	.1604	-2.11647	12.80206
Fncn(14)	15.0414**	6.16314	2.44	.0147	2.9618	27.1209
Fncn(15)	8.36904*	4.52336	1.85	.0643	-.49657	17.23465

```

-----
--

```

```

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
-----

```

```

--
|-> NLOGIT;
Lhs = choice, cset, alti;
Choices = a, b, c, d;
Model:
U(a)= csta*ATTB_A + cstb*ATTB_B +
      cstc*ATTB_C + cstd*ATTB_D +
      cste*ATTB_E + cstf*cost/
U(b)= csta*ATTB_A + cstb*ATTB_B +
      cstc*ATTB_C + cstd*ATTB_D +
      cste*ATTB_E + cstf*cost/
U(c)= csta*ATTB_A + cstb*ATTB_B +
      cstc*ATTB_C + cstd*ATTB_D +
      cste*ATTB_E + cstf*cost/
U(d)= ascd;
LCM= LIVEOTH;
parameters;

```

```

pts=3;
Pds = 8$;
Normal exit: 5 iterations. Status=0, F= 6169.598

```

```

-----
--
Discrete choice (multinomial logit) model
Dependent variable          Choice
Log likelihood function     -6169.59788
Estimation based on N =    5168, K =    7
Inf.Cr.AIC = 12353.2 AIC/N =    2.390
Model estimated: Jul 02, 2020, 13:29:46
R2=1-LogL/LogL* Log-L fncn R-sqrd R2Adj
Constants only must be computed directly
          Use NLOGIT ;...;RHS=ONE$
Response data are given as ind. choices
Number of obs.= 5168, skipped    0 obs
-----+-----
--

```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
CSTA 1	1.50800***	.08136	18.53	.0000	1.34853	1.66747
CSTB 1	.41312***	.08194	5.04	.0000	.25252	.57371
CSTC 1	.27535***	.07945	3.47	.0005	.11963	.43107
CSTD 1	-.12704	.08524	-1.49	.1361	-.29410	.04002
CSTE 1	.25096***	.08053	3.12	.0018	.09312	.40881
CSTF 1	-.03814***	.00830	-4.59	.0000	-.05442	-.02187
ASCD 1	.36529***	.12958	2.82	.0048	.11132	.61925

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

Line search at iteration 52 does not improve fn. Exiting optimization.

```

-----
--
Latent Class Logit Model
Dependent variable          CHOICE
Log likelihood function     -5348.27008
Restricted log likelihood   -7164.36926
Chi squared [ 25 d.f.]     3632.19836
Significance level         .00000
McFadden Pseudo R-squared  .2534904
Estimation based on N =    5168, K =    25
Inf.Cr.AIC = 10746.5 AIC/N =    2.079
Model estimated: Jul 02, 2020, 13:29:53
Constants only must be computed directly
          Use NLOGIT ;...;RHS=ONE$
At start values -6169.6289 .1331*****
Response data are given as ind. choices
Number of latent classes =    3
Average Class Probabilities
      .309 .416 .275
LCM model with panel has    646 groups
Fixed number of obsrvs./group=    8
Number of obs.= 5168, skipped    0 obs

```

```

-----+-----
--
|
CHOICE| Coefficient      Standard      Prob.      95% Confidence
      |      Error        z        |z|>Z*      Interval
-----+-----
--
|Utility parameters in latent class -->> 1
CSTA|1|      .81098***      .15625      5.19      .0000      .50473      1.11723
CSTB|1|      .99121***      .15773      6.28      .0000      .68207      1.30034
CSTC|1|      1.08101***      .16459      6.57      .0000      .75842      1.40360
CSTD|1|      .78527***      .17478      4.49      .0000      .44270      1.12783
CSTE|1|      .85595***      .15589      5.49      .0000      .55041      1.16150
CSTF|1|      -.07273***      .01646      -4.42     .0000      -.10499     -.04047
ASCD|1|      -.97489***      .30958      -3.15     .0016     -1.58166    -.36812
|Utility parameters in latent class -->> 2
CSTA|2|      2.55332***      .20884     12.23     .0000      2.14401     2.96263
CSTB|2|      -.06812         .20120      -.34      .7349     -.46246     .32622
CSTC|2|      -.15817         .17667      -.90      .3706     -.50445     .18810
CSTD|2|      -.73098***      .20131     -3.63     .0003     -1.12554    -.33643
CSTE|2|      .11801         .18748      .63       .5291     -.24944     .48546
CSTF|2|      .00015         .01986      .01       .9939     -.03876     .03907
ASCD|2|      -.63877*        .33954     -1.88     .0599     -1.30427    .02672
|Utility parameters in latent class -->> 3
CSTA|3|      1.85097***      .19488      9.50     .0000      1.46900     2.23294
CSTB|3|      .22671         .18860      1.20     .2293     -.14293     .59636
CSTC|3|      -.39837**       .19691     -2.02     .0431     -.78431     -.01244
CSTD|3|      -1.11534***     .20609     -5.41     .0000     -1.51927    -.71141
CSTE|3|      -.62577***      .19669     -3.18     .0015     -1.01128    -.24026
CSTF|3|      -.07296***      .01833     -3.98     .0001     -.10888     -.03703
ASCD|3|      .86136***       .30699      2.81     .0050      .25967      1.46305
|This is THETA(01) in class probability model.
Constant|      .00095         .12592      .01      .9940     -.24584     .24774
_LIVEO|1|      .81266**       .33720      2.41     .0160      .15176      1.47356
|This is THETA(02) in class probability model.
Constant|      .32481***      .12290      2.64     .0082      .08394      .56569
_LIVEO|2|      .67550**       .33814      2.00     .0458      .01276      1.33825
|This is THETA(03) in class probability model.
Constant|      0.0           .....(Fixed Parameter).....
_LIVEO|3|      0.0           .....(Fixed Parameter).....
-----+-----
--

```

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.  
Fixed parameter ... is constrained to equal the value or  
had a nonpositive st.error because of an earlier problem.

```

--
|->
|-> Wald;
    Pts=1000;
    Labels =
    b1,    b2,    b3,    b4,    b5,    b6,    a1,
    c1,    c2,    c3,    c4,    c5,    c6,    a2,
    d1,    d2,    d3,    d4,    d5,    d6,    a3,
    e1,e2,e3,e4,e5,e6;
    Start =      b;
    Var    =      varb;
    Fn1    =      b1/b6;
    Fn2    =      b2/b6;
    Fn3    =      b3/b6;
    Fn4    =      b4/b6;

```

```

Fn5    =      b5/b6;
Fn6    =      c1/c6;
Fn7    =      c2/c6;
Fn8    =      c3/c6;
Fn9    =      c4/c6;
Fn10   =      c5/c6;
Fn11   =      d1/d6;
Fn12   =      d2/d6;
Fn13   =      d3/d6;
Fn14   =      d4/d6;
Fn15   =      d5/d6$;

```

```

-----
--
WALD procedure. Estimates and standard errors
for nonlinear functions and joint test of
nonlinear restrictions.
Wald Statistic           =      236.22951
Prob. from Chi-squared[15] =      .00000
Functions are computed at means of variables
-----

```

```

-----
--

```

WaldFcns	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Fncn(1)	-11.1500***	1.15302	-9.67	.0000	-13.4099	-8.8901
Fncn(2)	-13.6279***	1.45306	-9.38	.0000	-16.4759	-10.7800
Fncn(3)	-14.8626***	1.62415	-9.15	.0000	-18.0459	-11.6793
Fncn(4)	-10.7965***	1.06829	-10.11	.0000	-12.8903	-8.7027
Fncn(5)	-11.7684***	1.21873	-9.66	.0000	-14.1570	-9.3797
Fncn(6)	16686.6	.2167D+07	.01	.9939	-4229627.7	4263000.9
Fncn(7)	-445.179	56594.71	-.01	.9937	-111368.780	110478.423
Fncn(8)	-1033.72	133129.3	-.01	.9938	-261962.39	259894.95
Fncn(9)	-4777.15	618745.3	-.01	.9938	-1217495.64	1207941.33
Fncn(10)	771.207	101178.6	.01	.9939	-197535.181	199077.596
Fncn(11)	-25.3703***	4.87837	-5.20	.0000	-34.9317	-15.8088
Fncn(12)	-3.10742	2.04055	-1.52	.1278	-7.10683	.89199
Fncn(13)	5.46029	3.84400	1.42	.1555	-2.07381	12.99438
Fncn(14)	15.2874**	6.22811	2.45	.0141	3.0805	27.4943
Fncn(15)	8.57711*	4.58188	1.87	.0612	-.40321	17.55743

```

-----
--

```

```

Note: nnnnn.D-xx or D+xx => multiply by 10 to -xx or +xx.
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
-----
--

```

```

|-> NLOGIT;
Lhs    =      choice,   cset,      alti;
Choices =      =      a,      b,          c,          d;
Model:
U(a)=  csta*ATTB_A      +      cspb*ATTB_B      +
      cstc*ATTB_C      +      cstd*ATTB_D      +
      cste*ATTB_E      +      cstf*cost/
U(b)=  csta*ATTB_A      +      cspb*ATTB_B      +
      cstc*ATTB_C      +      cstd*ATTB_D      +
      cste*ATTB_E      +      cstf*cost/
U(c)=  csta*ATTB_A      +      cspb*ATTB_B      +
      cstc*ATTB_C      +      cstd*ATTB_D      +
      cste*ATTB_E      +      cstf*cost/

```

```

U(d)= ascd;
LCM= LIVEPNTS;
parameters;
pts=3;
Pds = 8$;

```

Normal exit: 5 iterations. Status=0, F= 6169.598

```

-----
--
Discrete choice (multinomial logit) model
Dependent variable      Choice
Log likelihood function  -6169.59788
Estimation based on N = 5168, K = 7
Inf.Cr.AIC = 12353.2 AIC/N = 2.390
Model estimated: Jul 02, 2020, 13:29:54
R2=1-LogL/LogL* Log-L fncn R-sqrd R2Adj
Constants only must be computed directly
      Use NLOGIT ;...;RHS=ONE$
Response data are given as ind. choices
Number of obs.= 5168, skipped 0 obs
-----

```

```

-----
--

```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
CSTA 1	1.50800***	.08136	18.53	.0000	1.34853	1.66747
CSTB 1	.41312***	.08194	5.04	.0000	.25252	.57371
CSTC 1	.27535***	.07945	3.47	.0005	.11963	.43107
CSTD 1	-.12704	.08524	-1.49	.1361	-.29410	.04002
CSTE 1	.25096***	.08053	3.12	.0018	.09312	.40881
CSTF 1	-.03814***	.00830	-4.59	.0000	-.05442	-.02187
ASCD 1	.36529***	.12958	2.82	.0048	.11132	.61925

```

-----

```

```

--
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
-----

```

Normal exit: 52 iterations. Status=0, F= 5350.039

```

-----
--
Latent Class Logit Model
Dependent variable      CHOICE
Log likelihood function  -5350.03910
Restricted log likelihood -7164.36926
Chi squared [ 25 d.f.]  3628.66031
Significance level      .00000
McFadden Pseudo R-squared .2532435
Estimation based on N = 5168, K = 25
Inf.Cr.AIC = 10750.1 AIC/N = 2.080
Model estimated: Jul 02, 2020, 13:29:59
Constants only must be computed directly
      Use NLOGIT ;...;RHS=ONE$
At start values -6169.6289 .1328*****
Response data are given as ind. choices
Number of latent classes = 3
Average Class Probabilities
      .309 .417 .274
LCM model with panel has 646 groups

```

Fixed number of obsrvs./group= 8  
 Number of obs.= 5168, skipped 0 obs

```
-----+-----
```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
-----+-----						
--						
Utility parameters in latent class --> 1						
CSTA 1	.80770***	.15757	5.13	.0000	.49888	1.11653
CSTB 1	.98732***	.15886	6.22	.0000	.67597	1.29868
CSTC 1	1.08075***	.16603	6.51	.0000	.75534	1.40616
CSTD 1	.78613***	.17650	4.45	.0000	.44019	1.13207
CSTE 1	.85716***	.15691	5.46	.0000	.54962	1.16471
CSTF 1	-.07267***	.01658	-4.38	.0000	-.10517	-.04018
ASCD 1	-.94080***	.30653	-3.07	.0021	-1.54158	-.34002
Utility parameters in latent class --> 2						
CSTA 2	2.54775***	.20836	12.23	.0000	2.13937	2.95613
CSTB 2	-.04993	.20030	-.25	.8031	-.44251	.34264
CSTC 2	-.15767	.17696	-.89	.3729	-.50450	.18915
CSTD 2	-.73088***	.20159	-3.63	.0003	-1.12599	-.33577
CSTE 2	.11155	.18763	.59	.5522	-.25619	.47930
CSTF 2	-.00025	.01979	-.01	.9901	-.03904	.03855
ASCD 2	-.66318*	.34083	-1.95	.0517	-1.33120	.00484
Utility parameters in latent class --> 3						
CSTA 3	1.87265***	.19724	9.49	.0000	1.48608	2.25923
CSTB 3	.22302	.18779	1.19	.2350	-.14505	.59109
CSTC 3	-.39021**	.19793	-1.97	.0487	-.77814	-.00228
CSTD 3	-1.09804***	.20705	-5.30	.0000	-1.50386	-.69222
CSTE 3	-.61460***	.19632	-3.13	.0017	-.99937	-.22983
CSTF 3	-.07358***	.01842	-3.99	.0001	-.10969	-.03747
ASCD 3	.88959***	.30917	2.88	.0040	.28363	1.49554
This is THETA(01) in class probability model.						
Constant	.07867	.12147	.65	.5172	-.15939	.31674
_LIVEP 1	.83339	.59614	1.40	.1621	-.33503	2.00182
This is THETA(02) in class probability model.						
Constant	.41636***	.11762	3.54	.0004	.18583	.64689
_LIVEP 2	.03149	.64825	.05	.9613	-1.23905	1.30203
This is THETA(03) in class probability model.						
Constant	0.0	.....(Fixed Parameter).....				
_LIVEP 3	0.0	.....(Fixed Parameter).....				

```
-----+-----
```

--  
 Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.  
 Fixed parameter ... is constrained to equal the value or  
 had a nonpositive st.error because of an earlier problem.  
 -----+-----

```
--
|->
|-> Wald;
  Pts=1000;
  Labels =
  b1,    b2,    b3,    b4,    b5,    b6,    a1,
  c1,    c2,    c3,    c4,    c5,    c6,    a2,
  d1,    d2,    d3,    d4,    d5,    d6,    a3,
  e1,e2,e3,e4,e5,e6;
  Start =          b;
  Var    =          varb;
  Fn1    =          b1/b6;
  Fn2    =          b2/b6;
```

```

Fn3    =      b3/b6;
Fn4    =      b4/b6;
Fn5    =      b5/b6;
Fn6    =      c1/c6;
Fn7    =      c2/c6;
Fn8    =      c3/c6;
Fn9    =      c4/c6;
Fn10   =      c5/c6;
Fn11   =      d1/d6;
Fn12   =      d2/d6;
Fn13   =      d3/d6;
Fn14   =      d4/d6;
Fn15   =      d5/d6$;

```

```

-----
--
WALD procedure. Estimates and standard errors
for nonlinear functions and joint test of
nonlinear restrictions.
Wald Statistic           =      237.23331
Prob. from Chi-squared[15] =      .00000
Functions are computed at means of variables
-----+-----
--

```

WaldFcns	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Fncn(1)	-11.1141***	1.15065	-9.66	.0000	-13.3693	-8.8589
Fncn(2)	-13.5856***	1.45677	-9.33	.0000	-16.4409	-10.7304
Fncn(3)	-14.8712***	1.63061	-9.12	.0000	-18.0672	-11.6753
Fncn(4)	-10.8173***	1.07322	-10.08	.0000	-12.9207	-8.7138
Fncn(5)	-11.7946***	1.22761	-9.61	.0000	-14.2007	-9.3886
Fncn(6)	-10390.6	838067.6	-.01	.9901	-1652973.0	1632191.7
Fncn(7)	203.647	17174.52	.01	.9905	-33457.803	33865.096
Fncn(8)	643.052	52546.80	.01	.9902	-102346.776	103632.881
Fncn(9)	2980.80	241360.1	.01	.9901	-470076.36	476037.97
Fncn(10)	-454.945	36039.54	-.01	.9899	-71091.145	70181.255
Fncn(11)	-25.4510***	4.86219	-5.23	.0000	-34.9807	-15.9213
Fncn(12)	-3.03100	2.02581	-1.50	.1346	-7.00152	.93952
Fncn(13)	5.30330	3.79891	1.40	.1627	-2.14243	12.74904
Fncn(14)	14.9233**	6.12653	2.44	.0149	2.9155	26.9311
Fncn(15)	8.35291*	4.49788	1.86	.0633	-.46278	17.16860

```

-----+-----
--
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
-----
--

```

```

|-> NLOGIT;
Lhs    =      choice,   cset,   alti;
Choices =      =,      a,      b,      c,      d;
Model:
U(a) =  csta*ATTB_A      +      cstb*ATTB_B      +
        cstc*ATTB_C      +      cstd*ATTB_D      +
        cste*ATTB_E
U(b) =  csta*ATTB_A      +      cstb*ATTB_B      +
        cstc*ATTB_C      +      cstd*ATTB_D      +
        cste*ATTB_E      +      cstf*cost/

```

```

U(c)=  csta*ATTB_A          +          cstb*ATTB_B          +
        cstc*ATTB_C          +          cstd*ATTB_D          +
        cste*ATTB_E          +          cstf*cost/
U(d)=  ascd;
LCM=  LIVESCOT;
parameters;
pts=3;
Pds   =          8$;

```

Normal exit: 5 iterations. Status=0, F= 6169.598

```

-----
--
Discrete choice (multinomial logit) model
Dependent variable      Choice
Log likelihood function -6169.59788
Estimation based on N = 5168, K = 7
Inf.Cr.AIC = 12353.2 AIC/N = 2.390
Model estimated: Jul 02, 2020, 13:30:00
R2=1-LogL/LogL* Log-L fncn R-sqrd R2Adj
Constants only must be computed directly
      Use NLOGIT ;...;RHS=ONE$
Response data are given as ind. choices
Number of obs.= 5168, skipped 0 obs
-----

```

```

-----
--

```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
CSTA 1	1.50800***	.08136	18.53	.0000	1.34853	1.66747
CSTB 1	.41312***	.08194	5.04	.0000	.25252	.57371
CSTC 1	.27535***	.07945	3.47	.0005	.11963	.43107
CSTD 1	-.12704	.08524	-1.49	.1361	-.29410	.04002
CSTE 1	.25096***	.08053	3.12	.0018	.09312	.40881
CSTF 1	-.03814***	.00830	-4.59	.0000	-.05442	-.02187
ASCD 1	.36529***	.12958	2.82	.0048	.11132	.61925

```

-----

```

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

```

-----
--
Normal exit: 50 iterations. Status=0, F= 5349.528
-----

```

```

--
Latent Class Logit Model
Dependent variable      CHOICE
Log likelihood function -5349.52752
Restricted log likelihood -7164.36926
Chi squared [ 25 d.f.] 3629.68347
Significance level      .00000
McFadden Pseudo R-squared .2533149
Estimation based on N = 5168, K = 25
Inf.Cr.AIC = 10749.1 AIC/N = 2.080
Model estimated: Jul 02, 2020, 13:30:05
Constants only must be computed directly
      Use NLOGIT ;...;RHS=ONE$
At start values -6169.6289 .1329*****
Response data are given as ind. choices
Number of latent classes = 3

```



Average Class Probabilities

.308 .416 .276

LCM model with panel has 646 groups

Fixed number of obsrvs./group= 8

Number of obs.= 5168, skipped 0 obs

```
-----+-----
```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
-----+-----						
--						
Utility parameters in latent class -->> 1						
CSTA 1	.81767***	.15654	5.22	.0000	.51084	1.12449
CSTB 1	.99599***	.15826	6.29	.0000	.68580	1.30618
CSTC 1	1.08865***	.16484	6.60	.0000	.76557	1.41174
CSTD 1	.79904***	.17571	4.55	.0000	.45465	1.14343
CSTE 1	.86087***	.15688	5.49	.0000	.55339	1.16834
CSTF 1	-.07348***	.01649	-4.46	.0000	-.10579	-.04116
ASCD 1	-.95165***	.30994	-3.07	.0021	-1.55912	-.34419
Utility parameters in latent class -->> 2						
CSTA 2	2.53497***	.20917	12.12	.0000	2.12500	2.94493
CSTB 2	-.06847	.20145	-.34	.7339	-.46331	.32637
CSTC 2	-.16591	.17706	-.94	.3487	-.51295	.18112
CSTD 2	-.74375***	.20232	-3.68	.0002	-1.14030	-.34721
CSTE 2	.10836	.18803	.58	.5644	-.26017	.47689
CSTF 2	.00100	.01988	.05	.9597	-.03796	.03997
ASCD 2	-.68090**	.34255	-1.99	.0468	-1.35229	-.00952
Utility parameters in latent class -->> 3						
CSTA 3	1.85966***	.19554	9.51	.0000	1.47641	2.24292
CSTB 3	.22347	.18724	1.19	.2327	-.14352	.59046
CSTC 3	-.38838**	.19637	-1.98	.0480	-.77326	-.00350
CSTD 3	-1.10377***	.20598	-5.36	.0000	-1.50749	-.70006
CSTE 3	-.61167***	.19613	-3.12	.0018	-.99607	-.22727
CSTF 3	-.07319***	.01832	-4.00	.0001	-.10909	-.03729
ASCD 3	.87690***	.30743	2.85	.0043	.27435	1.47944
This is THETA(01) in class probability model.						
Constant	.16787	.12267	1.37	.1712	-.07255	.40830
_LIVES 1	-.84337*	.49290	-1.71	.0871	-1.80945	.12270
This is THETA(02) in class probability model.						
Constant	.41052***	.12257	3.35	.0008	.17028	.65076
_LIVES 2	.01609	.35919	.04	.9643	-.68790	.72008
This is THETA(03) in class probability model.						
Constant	0.0	.....(Fixed Parameter).....				
_LIVES 3	0.0	.....(Fixed Parameter).....				

```
-----+-----
```

--  
 Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.  
 Fixed parameter ... is constrained to equal the value or  
 had a nonpositive st.error because of an earlier problem.

```
--
|->
|-> Wald;
    Pts=1000;
    Labels =
    b1,    b2,    b3,    b4,    b5,    b6,    a1,
    c1,    c2,    c3,    c4,    c5,    c6,    a2,
    d1,    d2,    d3,    d4,    d5,    d6,    a3,
    e1,e2,e3,e4,e5,e6;
    Start =          b;
```

```

Var      =      varb;
Fn1      =      b1/b6;
Fn2      =      b2/b6;
Fn3      =      b3/b6;
Fn4      =      b4/b6;
Fn5      =      b5/b6;
Fn6      =      c1/c6;
Fn7      =      c2/c6;
Fn8      =      c3/c6;
Fn9      =      c4/c6;
Fn10     =      c5/c6;
Fn11     =      d1/d6;
Fn12     =      d2/d6;
Fn13     =      d3/d6;
Fn14     =      d4/d6;
Fn15     =      d5/d6;

```

```

-----
--
WALD procedure. Estimates and standard errors
for nonlinear functions and joint test of
nonlinear restrictions.
Wald Statistic          =      235.22352
Prob. from Chi-squared[15] =      .00000
Functions are computed at means of variables
-----

```

```

-----
--

```

WaldFcns	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Fncn(1)	-11.1284***	1.14324	-9.73	.0000	-13.3692	-8.8877
Fncn(2)	-13.5554***	1.44206	-9.40	.0000	-16.3818	-10.7291
Fncn(3)	-14.8166***	1.60717	-9.22	.0000	-17.9665	-11.6666
Fncn(4)	-10.8749***	1.07499	-10.12	.0000	-12.9819	-8.7680
Fncn(5)	-11.7164***	1.22673	-9.55	.0000	-14.1208	-9.3120
Fncn(6)	2523.19	50088.47	.05	.9598	-95648.40	100694.78
Fncn(7)	-68.1515	1172.000	-.06	.9536	-2365.2294	2228.9263
Fncn(8)	-165.144	3112.766	-.05	.9577	-6266.053	5935.766
Fncn(9)	-740.299	14464.60	-.05	.9592	-29090.401	27609.802
Fncn(10)	107.853	2302.872	.05	.9626	-4405.693	4621.400
Fncn(11)	-25.4084***	4.86920	-5.22	.0000	-34.9518	-15.8649
Fncn(12)	-3.05323	2.02426	-1.51	.1315	-7.02071	.91424
Fncn(13)	5.30639	3.79010	1.40	.1615	-2.12206	12.73484
Fncn(14)	15.0807**	6.15780	2.45	.0143	3.0116	27.1498
Fncn(15)	8.35721*	4.50940	1.85	.0638	-.48104	17.19547

```

-----
--

```

```

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
-----

```

```

|-> NLOGIT;
Lhs      =      choice,      cset,      alti;
Choices  =      a,          b,          c,          d;
Model:
U(a) =  csta*ATTB_A      +      cstb*ATTB_B      +
        cstc*ATTB_C      +      cstd*ATTB_D      +
        cste*ATTB_E      +      cstf*cost/

```

```

U(b)=  csta*ATTB_A          +          cstb*ATTB_B          +
       cstc*ATTB_C          +          cstd*ATTB_D          +
       cste*ATTB_E          +          cstf*cost/
U(c)=  csta*ATTB_A          +          cstb*ATTB_B          +
       cstc*ATTB_C          +          cstd*ATTB_D          +
       cste*ATTB_E          +          cstf*cost/
U(d)=  ascd;
LCM=  LIVENIRL;
parameters;
pts=3;
Pds   =          8$;
Normal exit:  5 iterations. Status=0, F=  6169.598

```

```

-----
--
Discrete choice (multinomial logit) model
Dependent variable      Choice
Log likelihood function  -6169.59788
Estimation based on N =  5168, K =  7
Inf.Cr.AIC = 12353.2 AIC/N =  2.390
Model estimated: Jul 02, 2020, 13:30:06
R2=1-LogL/LogL* Log-L fncn R-sqrd R2Adj
Constants only must be computed directly
          Use NLOGIT ;...;RHS=ONE$
Response data are given as ind. choices
Number of obs.=  5168, skipped  0 obs
-----

```

```

--

```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
CSTA 1	1.50800***	.08136	18.53	.0000	1.34853	1.66747
CSTB 1	.41312***	.08194	5.04	.0000	.25252	.57371
CSTC 1	.27535***	.07945	3.47	.0005	.11963	.43107
CSTD 1	-.12704	.08524	-1.49	.1361	-.29410	.04002
CSTE 1	.25096***	.08053	3.12	.0018	.09312	.40881
CSTF 1	-.03814***	.00830	-4.59	.0000	-.05442	-.02187
ASCD 1	.36529***	.12958	2.82	.0048	.11132	.61925

```

-----

```

```

--
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
-----

```

```

--
Line search at iteration 72 does not improve fn. Exiting optimization.
-----

```

```

--
Latent Class Logit Model
Dependent variable      CHOICE
Log likelihood function  -5350.23728
Restricted log likelihood -7164.36926
Chi squared [ 25 d.f.]  3628.26396
Significance level      .00000
McFadden Pseudo R-squared .2532159
Estimation based on N =  5168, K =  25
Inf.Cr.AIC = 10750.5 AIC/N =  2.080
Model estimated: Jul 02, 2020, 13:30:14
Constants only must be computed directly
          Use NLOGIT ;...;RHS=ONE$

```

At start values -6169.6289 .1328\*\*\*\*\*  
 Response data are given as ind. choices  
 Number of latent classes = 3  
 Average Class Probabilities  
 .310 .415 .275  
 LCM model with panel has 646 groups  
 Fixed number of obsrvs./group= 8  
 Number of obs.= 5168, skipped 0 obs

```
-----+-----
```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
-----+-----						
--						
Utility parameters in latent class --> 1						
CSTA 1	.82658***	.15503	5.33	.0000	.52273	1.13044
CSTB 1	.99499***	.15686	6.34	.0000	.68756	1.30243
CSTC 1	1.09265***	.16367	6.68	.0000	.77187	1.41342
CSTD 1	.80049***	.17350	4.61	.0000	.46044	1.14054
CSTE 1	.86765***	.15478	5.61	.0000	.56428	1.17101
CSTF 1	-.07360***	.01639	-4.49	.0000	-.10572	-.04148
ASCD 1	-.94411***	.30688	-3.08	.0021	-1.54558	-.34263
Utility parameters in latent class --> 2						
CSTA 2	2.54669***	.20969	12.15	.0000	2.13571	2.95768
CSTB 2	-.05902	.20148	-.29	.7696	-.45391	.33587
CSTC 2	-.17403	.17676	-.98	.3248	-.52048	.17241
CSTD 2	-.74836***	.20163	-3.71	.0002	-1.14355	-.35316
CSTE 2	.09968	.18775	.53	.5955	-.26830	.46765
CSTF 2	.00059	.01988	.03	.9763	-.03838	.03956
ASCD 2	-.67063**	.34167	-1.96	.0497	-1.34030	-.00096
Utility parameters in latent class --> 3						
CSTA 3	1.86315***	.19531	9.54	.0000	1.48035	2.24595
CSTB 3	.22146	.18718	1.18	.2368	-.14541	.58832
CSTC 3	-.38978**	.19669	-1.98	.0475	-.77528	-.00429
CSTD 3	-1.09859***	.20616	-5.33	.0000	-1.50266	-.69452
CSTE 3	-.61166***	.19643	-3.11	.0018	-.99666	-.22666
CSTF 3	-.07344***	.01833	-4.01	.0001	-.10937	-.03751
ASCD 3	.88149***	.30731	2.87	.0041	.27918	1.48380
This is THETA(01) in class probability model.						
Constant	.11154	.11769	.95	.3432	-.11912	.34220
_LIVEN 1	30.0817	.2549D+07	.00	1.0000 *****		
*****						
This is THETA(02) in class probability model.						
Constant	.41119***	.11671	3.52	.0004	.18244	.63994
_LIVEN 2	-4.78160	.2863D+08	.00	1.0000 *****		
*****						
This is THETA(03) in class probability model.						
Constant	0.0	.....(Fixed Parameter).....				
_LIVEN 3	0.0	.....(Fixed Parameter).....				

```
-----+-----
```

--  
 Note: nnnnn.D-xx or D+xx => multiply by 10 to -xx or +xx.  
 Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.  
 Fixed parameter ... is constrained to equal the value or  
 had a nonpositive st.error because of an earlier problem.

```
-----+-----
```

--  
 |->  
 |-> Wald;  
 Pts=1000;

```

Labels =
b1,    b2,    b3,    b4,    b5,    b6,    a1,
c1,    c2,    c3,    c4,    c5,    c6,    a2,
d1,    d2,    d3,    d4,    d5,    d6,    a3,
e1,e2,e3,e4,e5,e6;
Start  =      b;
Var    =      varb;
Fn1    =      b1/b6;
Fn2    =      b2/b6;
Fn3    =      b3/b6;
Fn4    =      b4/b6;
Fn5    =      b5/b6;
Fn6    =      c1/c6;
Fn7    =      c2/c6;
Fn8    =      c3/c6;
Fn9    =      c4/c6;
Fn10   =      c5/c6;
Fn11   =      d1/d6;
Fn12   =      d2/d6;
Fn13   =      d3/d6;
Fn14   =      d4/d6;
Fn15   =      d5/d6$;

```

```

-----
--
WALD procedure. Estimates and standard errors
for nonlinear functions and joint test of
nonlinear restrictions.

```

```

Wald Statistic          =      241.32976
Prob. from Chi-squared[15] =      .00000
Functions are computed at means of variables

```

```

-----
--

```

WaldFcns	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Fncn(1)	-11.2311***	1.14080	-9.84	.0000	-13.4670	-8.9951
Fncn(2)	-13.5193***	1.41236	-9.57	.0000	-16.2875	-10.7511
Fncn(3)	-14.8462***	1.59796	-9.29	.0000	-17.9781	-11.7142
Fncn(4)	-10.8765***	1.05592	-10.30	.0000	-12.9461	-8.8070
Fncn(5)	-11.7891***	1.20520	-9.78	.0000	-14.1512	-9.4269
Fncn(6)	4306.01	145034.1	.03	.9763	-279955.67	288567.70
Fncn(7)	-99.7919	3052.775	-.03	.9739	-6083.1220	5883.5381
Fncn(8)	-294.261	9628.729	-.03	.9756	-19166.223	18577.701
Fncn(9)	-1265.34	42226.53	-.03	.9761	-84027.82	81497.14
Fncn(10)	168.535	5951.776	.03	.9774	-11496.732	11833.801
Fncn(11)	-25.3696***	4.84127	-5.24	.0000	-34.8583	-15.8809
Fncn(12)	-3.01546	2.02117	-1.49	.1357	-6.97687	.94595
Fncn(13)	5.30750	3.78434	1.40	.1608	-2.10968	12.72467
Fncn(14)	14.9589**	6.11518	2.45	.0144	2.9734	26.9445
Fncn(15)	8.32863*	4.49295	1.85	.0638	-.47738	17.13465

```

-----
--

```

```

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
-----
--

```

```

|-> NLOGIT;
Lhs = choice, cset, alti;
Choices = a, b, c, d;

```

```

Model:
U(a)=  csta*ATTB_A          +          cstb*ATTB_B          +
       cstc*ATTB_C          +          cstd*ATTB_D          +
       cste*ATTB_E          +          cstf*cost/
U(b)=  csta*ATTB_A          +          cstb*ATTB_B          +
       cstc*ATTB_C          +          cstd*ATTB_D          +
       cste*ATTB_E          +          cstf*cost/
U(c)=  csta*ATTB_A          +          cstb*ATTB_B          +
       cstc*ATTB_C          +          cstd*ATTB_D          +
       cste*ATTB_E          +          cstf*cost/
U(d)=  ascd;
LCM= LIVBLANK;
parameters;
pts=3;
Pds   =           8$;
Normal exit:   5 iterations. Status=0, F=       6169.598

```

```

-----
--
Discrete choice (multinomial logit) model
Dependent variable           Choice
Log likelihood function      -6169.59788
Estimation based on N =    5168, K =    7
Inf.Cr.AIC = 12353.2 AIC/N =    2.390
Model estimated: Jul 02, 2020, 13:30:15
R2=1-LogL/LogL* Log-L fncn R-sqrd R2Adj
Constants only must be computed directly
                Use NLOGIT ;...;RHS=ONE$
Response data are given as ind. choices
Number of obs.=  5168, skipped    0 obs
-----

```

```

-----
--

```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
CSTA 1	1.50800***	.08136	18.53	.0000	1.34853	1.66747
CSTB 1	.41312***	.08194	5.04	.0000	.25252	.57371
CSTC 1	.27535***	.07945	3.47	.0005	.11963	.43107
CSTD 1	-.12704	.08524	-1.49	.1361	-.29410	.04002
CSTE 1	.25096***	.08053	3.12	.0018	.09312	.40881
CSTF 1	-.03814***	.00830	-4.59	.0000	-.05442	-.02187
ASCD 1	.36529***	.12958	2.82	.0048	.11132	.61925

```

-----

```

```

--
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
-----

```

```

--
Line search at iteration 51 does not improve fn. Exiting optimization.
-----

```

```

--
Latent Class Logit Model
Dependent variable           CHOICE
Log likelihood function      -5348.81633
Restricted log likelihood    -7164.36926
Chi squared [ 25 d.f.]      3631.10585
Significance level           .00000
McFadden Pseudo R-squared   .2534142
Estimation based on N =    5168, K =    25

```

```

Inf.Cr.AIC = 10747.6 AIC/N = 2.080
Model estimated: Jul 02, 2020, 13:30:22
Constants only must be computed directly
      Use NLOGIT ;...;RHS=ONE$
At start values -6169.6289 .1330*****
Response data are given as ind. choices
Number of latent classes = 3
Average Class Probabilities
      .310 .417 .273
LCM model with panel has 646 groups
Fixed number of obsrvs./group= 8
Number of obs.= 5168, skipped 0 obs

```

```

-----+-----
--

```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
-----+-----						
--						
Utility parameters in latent class -->> 1						
CSTA 1	.81410***	.15570	5.23	.0000	.50893	1.11926
CSTB 1	.99004***	.15691	6.31	.0000	.68250	1.29758
CSTC 1	1.08085***	.16404	6.59	.0000	.75933	1.40236
CSTD 1	.78772***	.17472	4.51	.0000	.44528	1.13016
CSTE 1	.86082***	.15558	5.53	.0000	.55588	1.16576
CSTF 1	-.07305***	.01641	-4.45	.0000	-.10521	-.04090
ASCD 1	-.96263***	.30708	-3.13	.0017	-1.56450	-.36077
Utility parameters in latent class -->> 2						
CSTA 2	2.55427***	.20787	12.29	.0000	2.14685	2.96169
CSTB 2	-.05036	.20058	-.25	.8018	-.44349	.34278
CSTC 2	-.15568	.17635	-.88	.3773	-.50132	.18995
CSTD 2	-.73378***	.20021	-3.66	.0002	-1.12619	-.34137
CSTE 2	.10733	.18702	.57	.5661	-.25922	.47387
CSTF 2	-.00033	.01977	-.02	.9866	-.03908	.03841
ASCD 2	-.63140*	.33821	-1.87	.0619	-1.29427	.03147
Utility parameters in latent class -->> 3						
CSTA 3	1.86067***	.19679	9.45	.0000	1.47496	2.24638
CSTB 3	.21955	.18789	1.17	.2426	-.14870	.58780
CSTC 3	-.39702**	.19760	-2.01	.0445	-.78430	-.00973
CSTD 3	-1.10055***	.20730	-5.31	.0000	-1.50685	-.69425
CSTE 3	-.61876***	.19732	-3.14	.0017	-1.00550	-.23202
CSTF 3	-.07348***	.01841	-3.99	.0001	-.10957	-.03739
ASCD 3	.88066***	.30939	2.85	.0044	.27426	1.48705
This is THETA(01) in class probability model.						
Constant	.13876	.12063	1.15	.2500	-.09766	.37519
_LIVBL 1	-.16342	.44408	-.37	.7129	-1.03380	.70696
This is THETA(02) in class probability model.						
Constant	.47980***	.11826	4.06	.0000	.24803	.71158
_LIVBL 2	-1.11305**	.52483	-2.12	.0339	-2.14169	-.08441
This is THETA(03) in class probability model.						
Constant	0.0	.....(Fixed Parameter).....				
_LIVBL 3	0.0	.....(Fixed Parameter).....				
-----+-----						
--						

```

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
Fixed parameter ... is constrained to equal the value or
had a nonpositive st.error because of an earlier problem.
-----+-----
--

```

```

|->
|-> Wald;

```

```

Pts=1000;
Labels =
b1,    b2,    b3,    b4,    b5,    b6,    a1,
c1,    c2,    c3,    c4,    c5,    c6,    a2,
d1,    d2,    d3,    d4,    d5,    d6,    a3,
e1,e2,e3,e4,e5,e6;
Start  =      b;
Var    =      varb;
Fn1    =      b1/b6;
Fn2    =      b2/b6;
Fn3    =      b3/b6;
Fn4    =      b4/b6;
Fn5    =      b5/b6;
Fn6    =      c1/c6;
Fn7    =      c2/c6;
Fn8    =      c3/c6;
Fn9    =      c4/c6;
Fn10   =      c5/c6;
Fn11   =      d1/d6;
Fn12   =      d2/d6;
Fn13   =      d3/d6;
Fn14   =      d4/d6;
Fn15   =      d5/d6$;

```

```

-----
--
WALD procedure. Estimates and standard errors
for nonlinear functions and joint test of
nonlinear restrictions.

```

```

Wald Statistic      =      238.69100
Prob. from Chi-squared[15] =      .00000
Functions are computed at means of variables

```

```

-----
--

```

WaldFcns	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Fncn(1)	-11.1441***	1.14385	-9.74	.0000	-13.3861	-8.9022
Fncn(2)	-13.5527***	1.43075	-9.47	.0000	-16.3569	-10.7485
Fncn(3)	-14.7957***	1.59899	-9.25	.0000	-17.9297	-11.6617
Fncn(4)	-10.7831***	1.07570	-10.02	.0000	-12.8914	-8.6748
Fncn(5)	-11.7837***	1.22043	-9.66	.0000	-14.1757	-9.3917
Fncn(6)	-7683.04	456370.2	-.02	.9866	-902152.15	886786.06
Fncn(7)	151.465	9551.415	.02	.9873	-18568.965	18871.895
Fncn(8)	468.280	28315.28	.02	.9868	-55028.651	55965.210
Fncn(9)	2207.14	131792.0	.02	.9866	-256100.52	260514.80
Fncn(10)	-322.825	18694.62	-.02	.9862	-36963.613	36317.962
Fncn(11)	-25.3225***	4.84271	-5.23	.0000	-34.8140	-15.8309
Fncn(12)	-2.98794	2.03433	-1.47	.1419	-6.97516	.99928
Fncn(13)	5.40318	3.81948	1.41	.1572	-2.08286	12.88922
Fncn(14)	14.9778**	6.13978	2.44	.0147	2.9441	27.0116
Fncn(15)	8.42091*	4.52646	1.86	.0628	-.45080	17.29261

```

-----
--

```

```

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
-----
--

```

```

|-> NLOGIT;
Lhs = choice, cset, alti;

```



```

Choices          =          a,          b,          c,          d;
Model:
U(a)=  csta*ATTB_A          +          cstb*ATTB_B          +
        cstc*ATTB_C          +          cstd*ATTB_D          +
        cste*ATTB_E          +          cstf*cost/
U(b)=  csta*ATTB_A          +          cstb*ATTB_B          +
        cstc*ATTB_C          +          cstd*ATTB_D          +
        cste*ATTB_E          +          cstf*cost/
U(c)=  csta*ATTB_A          +          cstb*ATTB_B          +
        cstc*ATTB_C          +          cstd*ATTB_D          +
        cste*ATTB_E          +          cstf*cost/
U(d)=  ascd;
LCM=  LIVESWAL;
parameters;
pts=3;
Pds   =          8$;
Normal exit:    5 iterations. Status=0, F=          6169.598

```

```

-----
--
Discrete choice (multinomial logit) model
Dependent variable          Choice
Log likelihood function      -6169.59788
Estimation based on N =    5168, K =    7
Inf.Cr.AIC = 12353.2 AIC/N =    2.390
Model estimated: Jul 02, 2020, 13:30:23
R2=1-LogL/LogL* Log-L fncn R-sqrd R2Adj
Constants only must be computed directly
          Use NLOGIT ;...;RHS=ONE$
Response data are given as ind. choices
Number of obs.=  5168, skipped    0 obs

```

```

-----
--

```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
CSTA 1	1.50800***	.08136	18.53	.0000	1.34853	1.66747
CSTB 1	.41312***	.08194	5.04	.0000	.25252	.57371
CSTC 1	.27535***	.07945	3.47	.0005	.11963	.43107
CSTD 1	-.12704	.08524	-1.49	.1361	-.29410	.04002
CSTE 1	.25096***	.08053	3.12	.0018	.09312	.40881
CSTF 1	-.03814***	.00830	-4.59	.0000	-.05442	-.02187
ASCD 1	.36529***	.12958	2.82	.0048	.11132	.61925

```

-----
--

```

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

Line search at iteration 53 does not improve fn. Exiting optimization.

```

-----
--
Latent Class Logit Model
Dependent variable          CHOICE
Log likelihood function      -5351.83521
Restricted log likelihood    -7164.36926
Chi squared [ 25 d.f.]      3625.06810
Significance level          .00000
McFadden Pseudo R-squared   .2529928

```

Estimation based on N = 5168, K = 25  
 Inf.Cr.AIC = 10753.7 AIC/N = 2.081  
 Model estimated: Jul 02, 2020, 13:30:29  
 Constants only must be computed directly  
 Use NLOGIT ;...;RHS=ONE\$  
 At start values -6169.6289 .1326\*\*\*\*\*  
 Response data are given as ind. choices  
 Number of latent classes = 3  
 Average Class Probabilities  
 .309 .416 .275  
 LCM model with panel has 646 groups  
 Fixed number of obsrvs./group= 8  
 Number of obs.= 5168, skipped 0 obs

```

-----+-----
--

```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
-----+-----						
--						
Utility parameters in latent class -->> 1						
CSTA 1	.81001***	.15623	5.18	.0000	.50380	1.11623
CSTB 1	.99092***	.15767	6.28	.0000	.68190	1.29994
CSTC 1	1.08106***	.16452	6.57	.0000	.75860	1.40351
CSTD 1	.78497***	.17472	4.49	.0000	.44252	1.12742
CSTE 1	.85682***	.15588	5.50	.0000	.55131	1.16234
CSTF 1	-.07271***	.01646	-4.42	.0000	-.10497	-.04045
ASCD 1	-.96139***	.30820	-3.12	.0018	-1.56544	-.35734
Utility parameters in latent class -->> 2						
CSTA 2	2.55064***	.20955	12.17	.0000	2.13992	2.96135
CSTB 2	-.05845	.20102	-.29	.7712	-.45243	.33554
CSTC 2	-.15890	.17680	-.90	.3688	-.50542	.18763
CSTD 2	-.73231***	.20154	-3.63	.0003	-1.12733	-.33729
CSTE 2	.11220	.18769	.60	.5500	-.25566	.48006
CSTF 2	-.57984D-06	.01983	.00	1.0000	-.38859D-01	.38858D-01
ASCD 2	-.65816*	.34150	-1.93	.0539	-1.32747	.01116
Utility parameters in latent class -->> 3						
CSTA 3	1.86404***	.19565	9.53	.0000	1.48057	2.24751
CSTB 3	.22075	.18822	1.17	.2409	-.14815	.58965
CSTC 3	-.39102**	.19689	-1.99	.0470	-.77691	-.00513
CSTD 3	-1.09920***	.20639	-5.33	.0000	-1.50373	-.69468
CSTE 3	-.61247***	.19720	-3.11	.0019	-.99898	-.22597
CSTF 3	-.07338***	.01838	-3.99	.0001	-.10942	-.03735
ASCD 3	.88070***	.30843	2.86	.0043	.27618	1.48521
This is THETA(01) in class probability model.						
Constant	.12181	.11976	1.02	.3091	-.11291	.35653
_LIVES 1	-.18517	.75256	-.25	.8056	-1.66016	1.28982
This is THETA(02) in class probability model.						
Constant	.41490***	.11927	3.48	.0005	.18115	.64866
_LIVES 2	-.03877	.69166	-.06	.9553	-1.39440	1.31687
This is THETA(03) in class probability model.						
Constant	0.0	.....(Fixed Parameter).....				
_LIVES 3	0.0	.....(Fixed Parameter).....				
-----+-----						
--						

Note: nnnnn.D-xx or D+xx => multiply by 10 to -xx or +xx.  
 Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.  
 Fixed parameter ... is constrained to equal the value or  
 had a nonpositive st.error because of an earlier problem.

```

|->
|-> Wald;
    Pts=1000;
    Labels =
    b1,    b2,    b3,    b4,    b5,    b6,    a1,
    c1,    c2,    c3,    c4,    c5,    c6,    a2,
    d1,    d2,    d3,    d4,    d5,    d6,    a3,
    e1,e2,e3,e4,e5,e6;
    Start =      b;
    Var    =      varb;
    Fn1    =      b1/b6;
    Fn2    =      b2/b6;
    Fn3    =      b3/b6;
    Fn4    =      b4/b6;
    Fn5    =      b5/b6;
    Fn6    =      c1/c6;
    Fn7    =      c2/c6;
    Fn8    =      c3/c6;
    Fn9    =      c4/c6;
    Fn10   =      c5/c6;
    Fn11   =      d1/d6;
    Fn12   =      d2/d6;
    Fn13   =      d3/d6;
    Fn14   =      d4/d6;
    Fn15   =      d5/d6$;

```

```

-----
--
WALD procedure. Estimates and standard errors
for nonlinear functions and joint test of
nonlinear restrictions.
Wald Statistic          =      235.82637
Prob. from Chi-squared[15] =      .00000
Functions are computed at means of variables
-----

```

	WaldFcns	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Fncn(1)		-11.1410***	1.15151	-9.68	.0000	-13.3979	-8.8841
Fncn(2)		-13.6292***	1.46140	-9.33	.0000	-16.4935	-10.7649
Fncn(3)		-14.8689***	1.62754	-9.14	.0000	-18.0588	-11.6790
Fncn(4)		-10.7966***	1.06976	-10.09	.0000	-12.8933	-8.6999
Fncn(5)		-11.7848***	1.22341	-9.63	.0000	-14.1826	-9.3869
Fncn(6)		-.43988D+07	.7618D+11	.00	1.0000	-.14932D+12	.14931D+12
Fncn(7)		100796	.1745D+10	.00	1.0000	874151295	-873949703
Fncn(8)		274035	.4746D+10	.00	1.0000	-711407515	711955586
Fncn(9)		.12629D+07	.2187D+11	.00	1.0000	-.42869D+11	.42871D+11
Fncn(10)		-193503	.3352D+10	.00	1.0000	2020695286	-
2021082293							
Fncn(11)		-25.4013***	4.89687	-5.19	.0000	-34.9989	-15.8036
Fncn(12)		-3.00816	2.05024	-1.47	.1423	-7.02655	1.01024
Fncn(13)		5.32842	3.79848	1.40	.1607	-2.11646	12.77329
Fncn(14)		14.9788**	6.13916	2.44	.0147	2.9463	27.0113
Fncn(15)		8.34616*	4.51778	1.85	.0647	-.50853	17.20085

```

-----
--
Note: nnnnn.D-xx or D+xx => multiply by 10 to -xx or +xx.
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.

```

```

-----
--
|-> NLOGIT;
  lhs      =          choice,      cset,      alti;
  Choices  =          a,          b,          c,          d;
  Model:
  U(a)=  csta*ATTB_A      +          cstb*ATTB_B      +
         cstc*ATTB_C      +          cstd*ATTB_D      +
         cste*ATTB_E      +          cstf*cost/
  U(b)=  csta*ATTB_A      +          cstb*ATTB_B      +
         cstc*ATTB_C      +          cstd*ATTB_D      +
         cste*ATTB_E      +          cstf*cost/
  U(c)=  csta*ATTB_A      +          cstb*ATTB_B      +
         cstc*ATTB_C      +          cstd*ATTB_D      +
         cste*ATTB_E      +          cstf*cost/
  U(d)=  ascd;
  LCM=  LIVENWAL;
  parameters;
  pts=3;
  Pds      =          8$;
Normal exit:  5 iterations. Status=0, F=          6169.598

```

```

-----
--
Discrete choice (multinomial logit) model
Dependent variable      Choice
Log likelihood function  -6169.59788
Estimation based on N =  5168, K =  7
Inf.Cr.AIC = 12353.2 AIC/N =  2.390
Model estimated: Jul 02, 2020, 13:30:30
R2=1-LogL/LogL* Log-L fncn R-sqrd R2Adj
Constants only must be computed directly
      Use NLOGIT ;...;RHS=ONE$
Response data are given as ind. choices
Number of obs.=  5168, skipped  0 obs

```

```

-----
--

```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
CSTA 1	1.50800***	.08136	18.53	.0000	1.34853	1.66747
CSTB 1	.41312***	.08194	5.04	.0000	.25252	.57371
CSTC 1	.27535***	.07945	3.47	.0005	.11963	.43107
CSTD 1	-.12704	.08524	-1.49	.1361	-.29410	.04002
CSTE 1	.25096***	.08053	3.12	.0018	.09312	.40881
CSTF 1	-.03814***	.00830	-4.59	.0000	-.05442	-.02187
ASCD 1	.36529***	.12958	2.82	.0048	.11132	.61925

```

-----
--

```

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

Line search at iteration 54 does not improve fn. Exiting optimization.

```

-----
--
Latent Class Logit Model
Dependent variable      CHOICE

```

```

Log likelihood function      -5351.41224
Restricted log likelihood    -7164.36926
Chi squared [ 25 d.f.]      3625.91403
Significance level          .00000
McFadden Pseudo R-squared   .2530519
Estimation based on N =    5168, K = 25
Inf.Cr.AIC = 10752.8 AIC/N = 2.081
Model estimated: Jul 02, 2020, 13:30:38
Constants only must be computed directly
      Use NLOGIT ;...;RHS=ONE$
At start values -6169.6289 .1326*****
Response data are given as ind. choices
Number of latent classes = 3
Average Class Probabilities
      .307 .419 .274
LCM model with panel has    646 groups
Fixed number of obsrvs./group= 8
Number of obs.= 5168, skipped 0 obs

```

```

-----+-----
--

```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
-----+-----						
--						
Utility parameters in latent class -->> 1						
CSTA 1	.80568***	.15663	5.14	.0000	.49870	1.11267
CSTB 1	.99136***	.15815	6.27	.0000	.68141	1.30132
CSTC 1	1.08308***	.16525	6.55	.0000	.75920	1.40695
CSTD 1	.78775***	.17528	4.49	.0000	.44421	1.13129
CSTE 1	.85865***	.15641	5.49	.0000	.55209	1.16520
CSTF 1	-.07265***	.01650	-4.40	.0000	-.10498	-.04031
ASCD 1	-.96418***	.30962	-3.11	.0018	-1.57101	-.35734
Utility parameters in latent class -->> 2						
CSTA 2	2.53635***	.20798	12.20	.0000	2.12872	2.94397
CSTB 2	-.05641	.19982	-.28	.7777	-.44804	.33523
CSTC 2	-.15885	.17604	-.90	.3669	-.50389	.18618
CSTD 2	-.73140***	.20047	-3.65	.0003	-1.12432	-.33848
CSTE 2	.10564	.18659	.57	.5713	-.26008	.47135
CSTF 2	.00018	.01972	.01	.9928	-.03847	.03883
ASCD 2	-.65761*	.34029	-1.93	.0533	-1.32456	.00934
Utility parameters in latent class -->> 3						
CSTA 3	1.86315***	.19572	9.52	.0000	1.47955	2.24674
CSTB 3	.22068	.18827	1.17	.2411	-.14832	.58969
CSTC 3	-.39459**	.19723	-2.00	.0454	-.78115	-.00804
CSTD 3	-1.10187***	.20681	-5.33	.0000	-1.50720	-.69654
CSTE 3	-.61307***	.19699	-3.11	.0019	-.99917	-.22698
CSTF 3	-.07373***	.01848	-3.99	.0001	-.10996	-.03750
ASCD 3	.87922***	.30818	2.85	.0043	.27521	1.48324
This is THETA(01) in class probability model.						
Constant	.11310	.11864	.95	.3405	-.11944	.34563
_LIVEN 1	.20524	1.16679	.18	.8604	-2.08163	2.49211
This is THETA(02) in class probability model.						
Constant	.40888***	.11831	3.46	.0005	.17700	.64076
_LIVEN 2	.85144	1.02082	.83	.4042	-1.14933	2.85221
This is THETA(03) in class probability model.						
Constant	0.0	..... (Fixed Parameter) .....				
_LIVEN 3	0.0	..... (Fixed Parameter) .....				
-----+-----						
--						

```

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
Fixed parameter ... is constrained to equal the value or

```

had a nonpositive st.error because of an earlier problem.

```
-----
--
|->
|-> Wald;
    Pts=1000;
    Labels =
    b1,    b2,    b3,    b4,    b5,    b6,    a1,
    c1,    c2,    c3,    c4,    c5,    c6,    a2,
    d1,    d2,    d3,    d4,    d5,    d6,    a3,
    e1,e2,e3,e4,e5,e6;
    Start =      b;
    Var     =      varb;
    Fn1    =      b1/b6;
    Fn2    =      b2/b6;
    Fn3    =      b3/b6;
    Fn4    =      b4/b6;
    Fn5    =      b5/b6;
    Fn6    =      c1/c6;
    Fn7    =      c2/c6;
    Fn8    =      c3/c6;
    Fn9    =      c4/c6;
    Fn10   =      c5/c6;
    Fn11   =      d1/d6;
    Fn12   =      d2/d6;
    Fn13   =      d3/d6;
    Fn14   =      d4/d6;
    Fn15   =      d5/d6$;
-----
```

WALD procedure. Estimates and standard errors for nonlinear functions and joint test of nonlinear restrictions.

Wald Statistic = 233.82529  
 Prob. from Chi-squared[15] = .00000  
 Functions are computed at means of variables

```
-----+-----
```

WaldFcns	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Fncn(1)	-11.0903***	1.14965	-9.65	.0000	-13.3436	-8.8370
Fncn(2)	-13.6462***	1.46257	-9.33	.0000	-16.5128	-10.7796
Fncn(3)	-14.9086***	1.64249	-9.08	.0000	-18.1278	-11.6894
Fncn(4)	-10.8434***	1.07779	-10.06	.0000	-12.9558	-8.7310
Fncn(5)	-11.8193***	1.23505	-9.57	.0000	-14.2400	-9.3986
Fncn(6)	14193.2	.1567D+07	.01	.9928	-3057171.0	3085557.3
Fncn(7)	-315.645	33829.88	-.01	.9926	-66620.993	65989.702
Fncn(8)	-888.927	97218.82	-.01	.9927	-191434.319	189656.465
Fncn(9)	-4092.84	450600.4	-.01	.9928	-887253.37	879067.69
Fncn(10)	591.127	66164.07	.01	.9929	-129088.069	130270.323
Fncn(11)	-25.2698***	4.86314	-5.20	.0000	-34.8014	-15.7382
Fncn(12)	-2.99313	2.02532	-1.48	.1394	-6.96268	.97641
Fncn(13)	5.35184	3.78868	1.41	.1578	-2.07383	12.77752
Fncn(14)	14.9446**	6.11151	2.45	.0145	2.9662	26.9229
Fncn(15)	8.31507*	4.48488	1.85	.0637	-.47513	17.10528

```
-----+-----
```

Note: nnnnn.D-xx or D+xx => multiply by 10 to -xx or +xx.  
 Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

```
-----
--
|-> NLOGIT;
  Lhs      =          choice,      cset,      alti;
  Choices  =          a,          b,          c,          d;
  Model:
  U(a)=      csta*ATTB_A          +          cstb*ATTB_B          +
            cstc*ATTB_C          +          cstd*ATTB_D          +
            cste*ATTB_E          +          cstf*cost/
  U(b)=      csta*ATTB_A          +          cstb*ATTB_B          +
            cstc*ATTB_C          +          cstd*ATTB_D          +
            cste*ATTB_E          +          cstf*cost/
  U(c)=      csta*ATTB_A          +          cstb*ATTB_B          +
            cstc*ATTB_C          +          cstd*ATTB_D          +
            cste*ATTB_E          +          cstf*cost/
  U(d)=      ascd;
  LCM=      LIVESWEN;
  parameters;
  pts=3;
  Pds      =          8$;
Normal exit:  5 iterations. Status=0, F=      6169.598
-----
```

```
-----
--
Discrete choice (multinomial logit) model
Dependent variable      Choice
Log likelihood function      -6169.59788
Estimation based on N =      5168, K =      7
Inf.Cr.AIC = 12353.2 AIC/N =      2.390
Model estimated: Jul 02, 2020, 13:30:39
R2=1-LogL/LogL* Log-L fncn R-sqrd R2Adj
Constants only must be computed directly
      Use NLOGIT ;...;RHS=ONE$
Response data are given as ind. choices
Number of obs.= 5168, skipped      0 obs
-----
```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
CSTA 1	1.50800***	.08136	18.53	.0000	1.34853	1.66747
CSTB 1	.41312***	.08194	5.04	.0000	.25252	.57371
CSTC 1	.27535***	.07945	3.47	.0005	.11963	.43107
CSTD 1	-.12704	.08524	-1.49	.1361	-.29410	.04002
CSTE 1	.25096***	.08053	3.12	.0018	.09312	.40881
CSTF 1	-.03814***	.00830	-4.59	.0000	-.05442	-.02187
ASCD 1	.36529***	.12958	2.82	.0048	.11132	.61925

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

Line search at iteration 52 does not improve fn. Exiting optimization.

```

Latent Class Logit Model
Dependent variable          CHOICE
Log likelihood function     -5350.13502
Restricted log likelihood   -7164.36926
Chi squared [ 25 d.f.]     3628.46847
Significance level         .00000
McFadden Pseudo R-squared .2532301
Estimation based on N =   5168, K = 25
Inf.Cr.AIC = 10750.3 AIC/N = 2.080
Model estimated: Jul 02, 2020, 13:30:45
Constants only must be computed directly
      Use NLOGIT ;...;RHS=ONE$
At start values -6169.6289 .1328*****
Response data are given as ind. choices
Number of latent classes = 3
Average Class Probabilities
      .309 .416 .275
LCM model with panel has 646 groups
Fixed number of obsrvs./group= 8
Number of obs.= 5168, skipped 0 obs

```

```

-----+-----
--

```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
-----+-----						
--						
Utility parameters in latent class -->> 1						
CSTA 1	.81084***	.15631	5.19	.0000	.50448	1.11721
CSTB 1	.98899***	.15768	6.27	.0000	.67994	1.29805
CSTC 1	1.08072***	.16440	6.57	.0000	.75851	1.40293
CSTD 1	.78589***	.17461	4.50	.0000	.44367	1.12811
CSTE 1	.85678***	.15569	5.50	.0000	.55164	1.16192
CSTF 1	-.07273***	.01650	-4.41	.0000	-.10506	-.04039
ASCD 1	-.96428***	.30842	-3.13	.0018	-1.56877	-.35980
Utility parameters in latent class -->> 2						
CSTA 2	2.55156***	.20900	12.21	.0000	2.14193	2.96118
CSTB 2	-.05377	.20117	-.27	.7892	-.44807	.34052
CSTC 2	-.15903	.17678	-.90	.3683	-.50551	.18745
CSTD 2	-.73310***	.20143	-3.64	.0003	-1.12789	-.33831
CSTE 2	.10689	.18761	.57	.5689	-.26082	.47460
CSTF 2	.69441D-04	.01982	.00	.9972	-.38772D-01	.38911D-01
ASCD 2	-.65910*	.34077	-1.93	.0531	-1.32701	.00880
Utility parameters in latent class -->> 3						
CSTA 3	1.86158***	.19509	9.54	.0000	1.47920	2.24395
CSTB 3	.22013	.18815	1.17	.2420	-.14863	.58889
CSTC 3	-.39006**	.19653	-1.98	.0472	-.77524	-.00488
CSTD 3	-1.09863***	.20591	-5.34	.0000	-1.50220	-.69506
CSTE 3	-.60235***	.19644	-3.07	.0022	-.98737	-.21732
CSTF 3	-.07373***	.01828	-4.03	.0001	-.10955	-.03790
ASCD 3	.88047***	.30706	2.87	.0041	.27864	1.48231
This is THETA(01) in class probability model.						
Constant	.07097	.12235	.58	.5619	-.16884	.31078
_LIVES 1	.59344	.44059	1.35	.1780	-.27010	1.45697
This is THETA(02) in class probability model.						
Constant	.35593***	.12168	2.93	.0034	.11745	.59442
_LIVES 2	.70435*	.42335	1.66	.0962	-.12540	1.53410
This is THETA(03) in class probability model.						
Constant	0.0	.....(Fixed Parameter).....				
_LIVES 3	0.0	.....(Fixed Parameter).....				
-----+-----						
--						



Note: nnnnn.D-xx or D+xx => multiply by 10 to -xx or +xx.  
 Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.  
 Fixed parameter ... is constrained to equal the value or  
 had a nonpositive st.error because of an earlier problem.

```
-----
--
|->
|-> Wald;
    Pts=1000;
    Labels =
    b1,   b2,       b3,       b4,       b5,       b6,       a1,
    c1,   c2,       c3,       c4,       c5,       c6,       a2,
    d1,   d2,       d3,       d4,       d5,       d6,       a3,
    e1,e2,e3,e4,e5,e6;
    Start =          b;
    Var    =          varb;
    Fn1    =          b1/b6;
    Fn2    =          b2/b6;
    Fn3    =          b3/b6;
    Fn4    =          b4/b6;
    Fn5    =          b5/b6;
    Fn6    =          c1/c6;
    Fn7    =          c2/c6;
    Fn8    =          c3/c6;
    Fn9    =          c4/c6;
    Fn10   =          c5/c6;
    Fn11   =          d1/d6;
    Fn12   =          d2/d6;
    Fn13   =          d3/d6;
    Fn14   =          d4/d6;
    Fn15   =          d5/d6$;
-----
```

```
-----
--
WALD procedure. Estimates and standard errors
for nonlinear functions and joint test of
nonlinear restrictions.
Wald Statistic          =      233.78332
Prob. from Chi-squared[15] =      .00000
Functions are computed at means of variables
-----+
```

```
-----
```

WaldFcns	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Fncn(1)	-11.1493***	1.16150	-9.60	.0000	-13.4258	-8.8728
Fncn(2)	-13.5989***	1.45348	-9.36	.0000	-16.4477	-10.7501
Fncn(3)	-14.8602***	1.63801	-9.07	.0000	-18.0706	-11.6497
Fncn(4)	-10.8061***	1.08140	-9.99	.0000	-12.9256	-8.6866
Fncn(5)	-11.7809***	1.24203	-9.49	.0000	-14.2152	-9.3466
Fncn(6)	36744.0	.1049D+08	.00	.9972	-20524432.3	20597920.3
Fncn(7)	-774.342	218433.9	.00	.9972	-428896.920	427348.236
Fncn(8)	-2290.12	651443.9	.00	.9972	-1279096.61	1274516.37
Fncn(9)	-10557.1	.3011D+07	.00	.9972	-5911592.6	5890478.4
Fncn(10)	1539.21	441775.1	.00	.9972	-864323.98	867402.40
Fncn(11)	-25.2494***	4.77710	-5.29	.0000	-34.6123	-15.8864
Fncn(12)	-2.98575	2.03664	-1.47	.1426	-6.97749	1.00600
Fncn(13)	5.29055	3.75938	1.41	.1593	-2.07770	12.65879
Fncn(14)	14.9012**	6.06179	2.46	.0140	3.0203	26.7821

```
-----
```

```
Fncn(15) |      8.16989*      4.43396      1.84      .0654      -.52051      16.86029
```

```
-----+-----
--
```

Note: nnnnn.D-xx or D+xx => multiply by 10 to -xx or +xx.

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

```
-----+-----
--
```

```
|-> NLOGIT;
  Lhs      =          choice,      cset,      alti;
  Choices  =          =          a,      b,      c,      d;
  Model:
  U(a)=  csta*ATTB_A      +          cstb*ATTB_B      +
         cstc*ATTB_C      +          cstd*ATTB_D      +
         cste*ATTB_E      +          cstf*cost/
  U(b)=  csta*ATTB_A      +          cstb*ATTB_B      +
         cstc*ATTB_C      +          cstd*ATTB_D      +
         cste*ATTB_E      +          cstf*cost/
  U(c)=  csta*ATTB_A      +          cstb*ATTB_B      +
         cstc*ATTB_C      +          cstd*ATTB_D      +
         cste*ATTB_E      +          cstf*cost/
  U(d)=  ascd;
  LCM= LIVESEEN;
  parameters;
  pts=3;
  Pds      =          8$;
```

Normal exit: 5 iterations. Status=0, F= 6169.598

```
-----+-----
--
```

Discrete choice (multinomial logit) model

Dependent variable Choice

Log likelihood function -6169.59788

Estimation based on N = 5168, K = 7

Inf.Cr.AIC = 12353.2 AIC/N = 2.390

Model estimated: Jul 02, 2020, 13:30:46

R2=1-LogL/LogL\* Log-L fncn R-sqrd R2Adj

Constants only must be computed directly

Use NLOGIT ;...;RHS=ONE\$

Response data are given as ind. choices

Number of obs.= 5168, skipped 0 obs

```
-----+-----
--
```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
CSTA 1	1.50800***	.08136	18.53	.0000	1.34853	1.66747
CSTB 1	.41312***	.08194	5.04	.0000	.25252	.57371
CSTC 1	.27535***	.07945	3.47	.0005	.11963	.43107
CSTD 1	-.12704	.08524	-1.49	.1361	-.29410	.04002
CSTE 1	.25096***	.08053	3.12	.0018	.09312	.40881
CSTF 1	-.03814***	.00830	-4.59	.0000	-.05442	-.02187
ASCD 1	.36529***	.12958	2.82	.0048	.11132	.61925

```
-----+-----
--
```

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

```
-----+-----
--
```

Line search at iteration 53 does not improve fn. Exiting optimization.

```

-----
--
Latent Class Logit Model
Dependent variable          CHOICE
Log likelihood function     -5351.33597
Restricted log likelihood   -7164.36926
Chi squared [ 25 d.f.]     3626.06658
Significance level          .00000
McFadden Pseudo R-squared  .2530625
Estimation based on N =    5168, K = 25
Inf.Cr.AIC = 10752.7 AIC/N = 2.081
Model estimated: Jul 02, 2020, 13:30:53
Constants only must be computed directly
      Use NLOGIT ;...;RHS=ONE$
At start values -6169.6289 .1326*****
Response data are given as ind. choices
Number of latent classes = 3
Average Class Probabilities
      .310 .416 .275
LCM model with panel has    646 groups
Fixed number of obsrvs./group= 8
Number of obs.= 5168, skipped 0 obs
-----
--
      |
      |          Standard      Prob.      95% Confidence
      | CHOICE| Coefficient      Error      z      |z|>Z*      Interval
      |-----+-----+-----+-----+-----+-----+-----+-----+-----+
--
      |
      | Utility parameters in latent class -->> 1
      | CSTA|1| .81189*** .15613 5.20 .0000 .50589 1.11790
      | CSTB|1| .99098*** .15774 6.28 .0000 .68181 1.30014
      | CSTC|1| 1.08201*** .16448 6.58 .0000 .75963 1.40438
      | CSTD|1| .78485*** .17468 4.49 .0000 .44248 1.12722
      | CSTE|1| .85694*** .15565 5.51 .0000 .55187 1.16200
      | CSTF|1| -.07283*** .01646 -4.42 .0000 -.10510 -.04056
      | ASCD|1| -.95651*** .30741 -3.11 .0019 -1.55902 -.35399
      |
      | Utility parameters in latent class -->> 2
      | CSTA|2| 2.55289*** .20934 12.19 .0000 2.14259 2.96319
      | CSTB|2| -.05971 .20123 -.30 .7667 -.45412 .33470
      | CSTC|2| -.15975 .17710 -.90 .3671 -.50686 .18737
      | CSTD|2| -.73119*** .20197 -3.62 .0003 -1.12705 -.33533
      | CSTE|2| .11386 .18799 .61 .5447 -.25458 .48231
      | CSTF|2| -.00013 .01988 -.01 .9946 -.03909 .03882
      | ASCD|2| -.65507* .34191 -1.92 .0554 -1.32521 .01506
      |
      | Utility parameters in latent class -->> 3
      | CSTA|3| 1.85996*** .19543 9.52 .0000 1.47693 2.24300
      | CSTB|3| .21882 .18750 1.17 .2432 -.14867 .58630
      | CSTC|3| -.39718** .19679 -2.02 .0436 -.78289 -.01148
      | CSTD|3| -1.10798*** .20657 -5.36 .0000 -1.51284 -.70312
      | CSTE|3| -.62105*** .19653 -3.16 .0016 -1.00624 -.23586
      | CSTF|3| -.07246*** .01843 -3.93 .0001 -.10858 -.03635
      | ASCD|3| .87678*** .30725 2.85 .0043 .27457 1.47898
      |
      | This is THETA(01) in class probability model.
      | Constant| .15061 .12955 1.16 .2450 -.10329 .40452
      | _LIVES|1| -.17387 .28864 -.60 .5469 -.73960 .39185
      |
      | This is THETA(02) in class probability model.
      | Constant| .46345*** .12666 3.66 .0003 .21520 .71170
      | _LIVES|2| -.28509 .27868 -1.02 .3063 -.83129 .26112
      |
      | This is THETA(03) in class probability model.
      | Constant| 0.0 .....(Fixed Parameter).....

```

```

_LIVES|3|          0.0      .....(Fixed Parameter).....
-----+-----

```

```

--
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
Fixed parameter ... is constrained to equal the value or
had a nonpositive st.error because of an earlier problem.
-----+-----

```

```

--
|-> Wald;
    Pts=1000;
    Labels =
    b1,    b2,        b3,        b4,        b5,        b6,        a1,
    c1,    c2,        c3,        c4,        c5,        c6,        a2,
    d1,    d2,        d3,        d4,        d5,        d6,        a3,
    e1,e2,e3,e4,e5,e6;
    Start =          b;
    Var    =          varb;
    Fn1    =          b1/b6;
    Fn2    =          b2/b6;
    Fn3    =          b3/b6;
    Fn4    =          b4/b6;
    Fn5    =          b5/b6;
    Fn6    =          c1/c6;
    Fn7    =          c2/c6;
    Fn8    =          c3/c6;
    Fn9    =          c4/c6;
    Fn10   =          c5/c6;
    Fn11   =          d1/d6;
    Fn12   =          d2/d6;
    Fn13   =          d3/d6;
    Fn14   =          d4/d6;
    Fn15   =          d5/d6$;

```

```

-----+-----
--
WALD procedure. Estimates and standard errors
for nonlinear functions and joint test of
nonlinear restrictions.

```

```

Wald Statistic          =      234.03764
Prob. from Chi-squared[15] =      .00000
Functions are computed at means of variables
-----+-----

```

```

--

```

WaldFcns	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Fncn(1)	-11.1478***	1.15322	-9.67	.0000	-13.4081	-8.8876
Fncn(2)	-13.6068***	1.44791	-9.40	.0000	-16.4446	-10.7690
Fncn(3)	-14.8567***	1.62320	-9.15	.0000	-18.0381	-11.6753
Fncn(4)	-10.7765***	1.07687	-10.01	.0000	-12.8871	-8.6659
Fncn(5)	-11.7663***	1.21886	-9.65	.0000	-14.1553	-9.3774
Fncn(6)	-18972.4	.2802D+07	-.01	.9946	-5510024.8	5472080.1
Fncn(7)	443.748	66900.88	.01	.9947	-130679.563	131567.059
Fncn(8)	1187.19	176551.1	.01	.9946	-344846.67	347221.06
Fncn(9)	5433.99	804142.9	.01	.9946	-1570657.08	1581525.06
Fncn(10)	-846.191	123760.1	-.01	.9945	-243411.475	241719.093
Fncn(11)	-25.6680***	5.01229	-5.12	.0000	-35.4919	-15.8441
Fncn(12)	-3.01974	2.05024	-1.47	.1408	-7.03814	.99866
Fncn(13)	5.48124	3.88119	1.41	.1579	-2.12574	13.08822

```

Fncn(14) |    15.2905**      6.29664      2.43  .0152      2.9493      27.6317
Fncn(15) |    8.57066*       4.62207      1.85  .0637     -0.48842     17.62975
-----+-----

```

```

--
Note: nnnnn.D-xx or D+xx => multiply by 10 to -xx or +xx.
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
-----+-----

```

```

--
|-> NLOGIT;
  Lhs      =          choice,      cset,          alti;
  Choices   =          a,          b,          c,          d;
  Model:
  U(a)=  csta*ATTB_A          +          cstb*ATTB_B          +
         cstc*ATTB_C          +          cstd*ATTB_D          +
         cste*ATTB_E          +          cstf*cost/
  U(b)=  csta*ATTB_A          +          cstb*ATTB_B          +
         cstc*ATTB_C          +          cstd*ATTB_D          +
         cste*ATTB_E          +          cstf*cost/
  U(c)=  csta*ATTB_A          +          cstb*ATTB_B          +
         cstc*ATTB_C          +          cstd*ATTB_D          +
         cste*ATTB_E          +          cstf*cost/
  U(d)=  ascD;
  LCM= LIVELDN;
  parameters;
  pts=3;
  Pds      =          8$;
Normal exit:  5 iterations. Status=0, F=          6169.598
-----+-----

```

```

--
Discrete choice (multinomial logit) model
Dependent variable          Choice
Log likelihood function      -6169.59788
Estimation based on N =    5168, K =    7
Inf.Cr.AIC = 12353.2 AIC/N =    2.390
Model estimated: Jul 02, 2020, 13:30:53
R2=1-LogL/LogL* Log-L fncn R-sqrd R2Adj
Constants only must be computed directly
          Use NLOGIT ;...;RHS=ONE$
Response data are given as ind. choices
Number of obs.= 5168, skipped    0 obs
-----+-----

```

```

--
          |          Standard          Prob.          95% Confidence
CHOICE|  Coefficient          Error          z          |z|>Z*          Interval
-----+-----
CSTA|1|    1.50800***          .08136          18.53  .0000          1.34853          1.66747
CSTB|1|    .41312***          .08194           5.04  .0000           .25252           .57371
CSTC|1|    .27535***          .07945           3.47  .0005           .11963           .43107
CSTD|1|   -0.12704          .08524          -1.49  .1361          -0.29410          .04002
CSTE|1|    .25096***          .08053           3.12  .0018           .09312           .40881
CSTF|1|   -0.03814***          .00830          -4.59  .0000          -0.05442          -0.02187
ASCDD|1|    .36529***          .12958           2.82  .0048           .11132           .61925
-----+-----

```

```

--
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
-----+-----

```

Line search at iteration 53 does not improve fn. Exiting optimization.

```

-----
--
Latent Class Logit Model
Dependent variable          CHOICE
Log likelihood function     -5351.76296
Restricted log likelihood   -7164.36926
Chi squared [ 25 d.f.]     3625.21261
Significance level         .00000
McFadden Pseudo R-squared  .2530029
Estimation based on N =   5168, K = 25
Inf.Cr.AIC = 10753.5 AIC/N = 2.081
Model estimated: Jul 02, 2020, 13:31:00
Constants only must be computed directly
      Use NLOGIT ;...;RHS=ONE$
At start values -6169.6289 .1326*****
Response data are given as ind. choices
Number of latent classes = 3
Average Class Probabilities
      .309 .416 .275
LCM model with panel has 646 groups
Fixed number of obsrvs./group= 8
Number of obs.= 5168, skipped 0 obs
-----
--
      |
      |          Standard      Prob.      95% Confidence
      | CHOICE| Coefficient      Error      z      |z|>Z*      Interval
-----+-----
--
      |Utility parameters in latent class -->> 1
CSTA|1|  .80910***  .15647  5.17  .0000  .50243  1.11577
CSTB|1|  .98939***  .15759  6.28  .0000  .68053  1.29826
CSTC|1|  1.07998***  .16458  6.56  .0000  .75741  1.40256
CSTD|1|  .78315***  .17479  4.48  .0000  .44056  1.12574
CSTE|1|  .85554***  .15583  5.49  .0000  .55011  1.16096
CSTF|1|  -.07257***  .01645  -4.41  .0000  -.10481  -.04032
ASCD|1|  -.96447***  .30806  -3.13  .0017  -1.56827  -.36068
      |Utility parameters in latent class -->> 2
CSTA|2|  2.55265***  .20919  12.20  .0000  2.14265  2.96265
CSTB|2|  -.05799  .20107  -.29  .7730  -.45209  .33611
CSTC|2|  -.15877  .17717  -.90  .3702  -.50602  .18848
CSTD|2|  -.73094***  .20205  -3.62  .0003  -1.12696  -.33492
CSTE|2|  .11329  .18782  .60  .5464  -.25482  .48140
CSTF|2| -.62934D-04  .01985  .00  .9975  -.38960D-01  .38834D-01
ASCD|2|  -.65577*  .34132  -1.92  .0547  -1.32474  .01319
      |Utility parameters in latent class -->> 3
CSTA|3|  1.86371***  .19522  9.55  .0000  1.48109  2.24633
CSTB|3|  .22175  .18747  1.18  .2369  -.14568  .58918
CSTC|3|  -.39021**  .19689  -1.98  .0475  -.77610  -.00431
CSTD|3|  -1.09927***  .20616  -5.33  .0000  -1.50334  -.69519
CSTE|3|  -.61203***  .19681  -3.11  .0019  -.99776  -.22629
CSTF|3|  -.07340***  .01834  -4.00  .0001  -.10935  -.03746
ASCD|3|  .88089***  .30726  2.87  .0041  .27868  1.48310
      |This is THETA(01) in class probability model.
Constant|  .10604  .12073  .88  .3798  -.13058  .34266
_LIVEL|1|  .17777  .45877  .39  .6984  -.72139  1.07694
      |This is THETA(02) in class probability model.
Constant|  .41245***  .11931  3.46  .0005  .17861  .64629
_LIVEL|2|  .01066  .46613  .02  .9817  -.90294  .92426
      |This is THETA(03) in class probability model.

```

```
Constant|          0.0      .....(Fixed Parameter).....
_LIVEL|3|          0.0      .....(Fixed Parameter).....
```

```
-----+-----
--
Note: nnnnn.D-xx or D+xx => multiply by 10 to -xx or +xx.
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
Fixed parameter ... is constrained to equal the value or
had a nonpositive st.error because of an earlier problem.
-----+-----
--
```

```
|-> Wald;
    Pts=1000;
    Labels =
    b1,    b2,        b3,        b4,        b5,        b6,        a1,
    c1,    c2,        c3,        c4,        c5,        c6,        a2,
    d1,    d2,        d3,        d4,        d5,        d6,        a3,
    e1,e2,e3,e4,e5,e6;
    Start =          b;
    Var    =          varb;
    Fn1    =          b1/b6;
    Fn2    =          b2/b6;
    Fn3    =          b3/b6;
    Fn4    =          b4/b6;
    Fn5    =          b5/b6;
    Fn6    =          c1/c6;
    Fn7    =          c2/c6;
    Fn8    =          c3/c6;
    Fn9    =          c4/c6;
    Fn10   =          c5/c6;
    Fn11   =          d1/d6;
    Fn12   =          d2/d6;
    Fn13   =          d3/d6;
    Fn14   =          d4/d6;
    Fn15   =          d5/d6$;
```

```
-----+-----
--
WALD procedure. Estimates and standard errors
for nonlinear functions and joint test of
nonlinear restrictions.
Wald Statistic          =      236.60686
Prob. from Chi-squared[15] =      .00000
Functions are computed at means of variables
-----+-----
--
```

WaldFcns	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Fncn(1)	-11.1497***	1.15729	-9.63	.0000	-13.4179	-8.8814
Fncn(2)	-13.6341***	1.45940	-9.34	.0000	-16.4945	-10.7738
Fncn(3)	-14.8825***	1.63235	-9.12	.0000	-18.0818	-11.6831
Fncn(4)	-10.7921***	1.07265	-10.06	.0000	-12.8944	-8.6897
Fncn(5)	-11.7895***	1.22643	-9.61	.0000	-14.1933	-9.3858
Fncn(6)	-40560.6	.1279D+08	.00	.9975	-25110558.9	25029437.8
Fncn(7)	921.460	293518.0	.00	.9975	-574363.179	576206.099
Fncn(8)	2522.76	798219.9	.00	.9975	-1561959.52	1567005.03
Fncn(9)	11614.3	.3666D+07	.00	.9975	-7174244.4	7197473.0
Fncn(10)	-1800.13	565128.9	.00	.9975	-1109432.38	1105832.11
Fncn(11)	-25.3899***	4.85526	-5.23	.0000	-34.9061	-15.8738

```

Fncn(12) |   -3.02093      2.02479     -1.49   .1357    -6.98944    .94757
Fncn(13) |    5.31592      3.79151      1.40   .1609    -2.11531   12.74714
Fncn(14) |   14.9756**      6.12401      2.45   .0145     2.9728    26.9785
Fncn(15) |    8.33783*      4.50291      1.85   .0641    - .48771   17.16336
-----+-----

```

```

--
Note: nnnnn.D-xx or D+xx => multiply by 10 to -xx or +xx.
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
-----+-----
--

```

```

|-> NLOGIT;
  lhs      =          choice,      cset,          alti;
  Choices   =          a,          b,           c,           d;
Model:
U(a)=  csta*ATTB_A          +          cstb*ATTB_B          +
       cstc*ATTB_C          +          cstd*ATTB_D          +
       cste*ATTB_E          +          cstf*cost/
U(b)=  csta*ATTB_A          +          cstb*ATTB_B          +
       cstc*ATTB_C          +          cstd*ATTB_D          +
       cste*ATTB_E          +          cstf*cost/
U(c)=  csta*ATTB_A          +          cstb*ATTB_B          +
       cstc*ATTB_C          +          cstd*ATTB_D          +
       cste*ATTB_E          +          cstf*cost/
U(d)=  ascd;
LCM= LIVEEEN;
parameters;
pts=3;
Pds      =          8$;
Normal exit:  5 iterations. Status=0, F=          6169.598
-----+-----

```

```

--
Discrete choice (multinomial logit) model
Dependent variable      Choice
Log likelihood function  -6169.59788
Estimation based on N =  5168, K =  7
Inf.Cr.AIC = 12353.2 AIC/N =  2.390
Model estimated: Jul 02, 2020, 13:31:01
R2=1-LogL/LogL* Log-L fncn R-sqrd R2Adj
Constants only must be computed directly
          Use NLOGIT ;...;RHS=ONE$
Response data are given as ind. choices
Number of obs.=  5168, skipped  0 obs
-----+-----

```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
CSTA 1	1.50800***	.08136	18.53	.0000	1.34853	1.66747
CSTB 1	.41312***	.08194	5.04	.0000	.25252	.57371
CSTC 1	.27535***	.07945	3.47	.0005	.11963	.43107
CSTD 1	-.12704	.08524	-1.49	.1361	-.29410	.04002
CSTE 1	.25096***	.08053	3.12	.0018	.09312	.40881
CSTF 1	-.03814***	.00830	-4.59	.0000	-.05442	-.02187
ASCD 1	.36529***	.12958	2.82	.0048	.11132	.61925

```

--
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.

```



-----  
 --  
 Line search at iteration 50 does not improve fn. Exiting optimization.  
 -----

--  
 Latent Class Logit Model  
 Dependent variable CHOICE  
 Log likelihood function -5351.63663  
 Restricted log likelihood -7164.36926  
 Chi squared [ 25 d.f.] 3625.46526  
 Significance level .00000  
 McFadden Pseudo R-squared .2530205  
 Estimation based on N = 5168, K = 25  
 Inf.Cr.AIC = 10753.3 AIC/N = 2.081  
 Model estimated: Jul 02, 2020, 13:31:07  
 Constants only must be computed directly  
 Use NLOGIT ;...;RHS=ONE\$  
 At start values -6169.6289 .1326\*\*\*\*\*  
 Response data are given as ind. choices  
 Number of latent classes = 3  
 Average Class Probabilities  
 .310 .415 .275  
 LCM model with panel has 646 groups  
 Fixed number of obsrvs./group= 8  
 Number of obs.= 5168, skipped 0 obs  
 -----

--

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
-----						
--						
Utility parameters in latent class -->> 1						
CSTA 1	.81031***	.15670	5.17	.0000	.50318	1.11744
CSTB 1	.98868***	.15765	6.27	.0000	.67968	1.29768
CSTC 1	1.07893***	.16503	6.54	.0000	.75548	1.40237
CSTD 1	.78279***	.17477	4.48	.0000	.44025	1.12533
CSTE 1	.85507***	.15557	5.50	.0000	.55016	1.15998
CSTF 1	-.07254***	.01645	-4.41	.0000	-.10479	-.04029
ASCD 1	-.96453***	.30838	-3.13	.0018	-1.56895	-.36011
Utility parameters in latent class -->> 2						
CSTA 2	2.55546***	.21022	12.16	.0000	2.14344	2.96748
CSTB 2	-.05840	.20238	-.29	.7729	-.45506	.33826
CSTC 2	-.15956	.17795	-.90	.3699	-.50834	.18922
CSTD 2	-.73216***	.20304	-3.61	.0003	-1.13010	-.33421
CSTE 2	.11342	.18822	.60	.5468	-.25549	.48233
CSTF 2	-.47011D-04	.01996	.00	.9981	-.39177D-01	.39083D-01
ASCD 2	-.65695*	.34262	-1.92	.0552	-1.32848	.01458
Utility parameters in latent class -->> 3						
CSTA 3	1.86336***	.19505	9.55	.0000	1.48106	2.24565
CSTB 3	.22124	.18728	1.18	.2375	-.14582	.58831
CSTC 3	-.38890**	.19643	-1.98	.0477	-.77389	-.00391
CSTD 3	-1.09946***	.20625	-5.33	.0000	-1.50370	-.69522
CSTE 3	-.61174***	.19618	-3.12	.0018	-.99625	-.22723
CSTF 3	-.07329***	.01832	-4.00	.0001	-.10920	-.03738
ASCD 3	.88093***	.30700	2.87	.0041	.27921	1.48264
This is THETA(01) in class probability model.						
Constant	.10004	.12114	.83	.4089	-.13739	.33747
_LIVEE 1	.28559	.46920	.61	.5427	-.63402	1.20520
This is THETA(02) in class probability model.						

```

Constant|      .39585***      .11957      3.31  .0009      .16149      .63020
_LIVEE|2|      .24933      .45342      .55  .5824      -.63937      1.13802
      |This is THETA(03) in class probability model.
Constant|          0.0      .....(Fixed Parameter).....
_LIVEE|3|          0.0      .....(Fixed Parameter).....

```

```

-----+-----
--
Note: nnnnn.D-xx or D+xx => multiply by 10 to -xx or +xx.
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
Fixed parameter ... is constrained to equal the value or
had a nonpositive st.error because of an earlier problem.
-----+-----
--

```

```

|->
|-> Wald;
    Pts=1000;
    Labels =
    b1,    b2,    b3,    b4,    b5,    b6,    a1,
    c1,    c2,    c3,    c4,    c5,    c6,    a2,
    d1,    d2,    d3,    d4,    d5,    d6,    a3,
    e1,e2,e3,e4,e5,e6;
    Start =          b;
    Var    =          varb;
    Fn1    =          b1/b6;
    Fn2    =          b2/b6;
    Fn3    =          b3/b6;
    Fn4    =          b4/b6;
    Fn5    =          b5/b6;
    Fn6    =          c1/c6;
    Fn7    =          c2/c6;
    Fn8    =          c3/c6;
    Fn9    =          c4/c6;
    Fn10   =          c5/c6;
    Fn11   =          d1/d6;
    Fn12   =          d2/d6;
    Fn13   =          d3/d6;
    Fn14   =          d4/d6;
    Fn15   =          d5/d6$;

```

```

-----+-----
--
WALD procedure. Estimates and standard errors
for nonlinear functions and joint test of
nonlinear restrictions.
Wald Statistic          =      236.33883
Prob. from Chi-squared[15] =      .00000
Functions are computed at means of variables
-----+-----
--

```

WaldFcns	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Fncn(1)	-11.1704***	1.16164	-9.62	.0000	-13.4472	-8.8937
Fncn(2)	-13.6293***	1.45693	-9.35	.0000	-16.4848	-10.7738
Fncn(3)	-14.8734***	1.63203	-9.11	.0000	-18.0721	-11.6747
Fncn(4)	-10.7910***	1.07145	-10.07	.0000	-12.8910	-8.6910
Fncn(5)	-11.7874***	1.22612	-9.61	.0000	-14.1906	-9.3843
Fncn(6)	-54358.3	.2309D+08	.00	.9981	-45312885.7	45204169.1
Fncn(7)	1242.26	531665.9	.00	.9981	-1040803.67	1043288.19

```

Fncn(8) |      3394.04      .1445D+07      .00      .9981 -2829470.25  2836258.33
Fncn(9) |     15574.0      .6621D+07      .00      .9981 -12961004.7  12992152.8
Fncn(10) |    -2412.60      .1021D+07      .00      .9981 -2004424.18  1999598.97
Fncn(11) |    -25.4235***      4.86357      -5.23      .0000      -34.9559  -15.8911
Fncn(12) |    -3.01863      2.02789      -1.49      .1366      -6.99322      .95596
Fncn(13) |      5.30616      3.78710      1.40      .1612      -2.11641  12.72873
Fncn(14) |     15.0009**      6.13294      2.45      .0144      2.9806  27.0213
Fncn(15) |      8.34659*      4.50171      1.85      .0637      -.47660  17.16979
-----+-----

```

```

--
Note: nnnnn.D-xx or D+xx => multiply by 10 to -xx or +xx.
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
-----+-----
--

```

```

|-> NLOGIT;
Lhs      =          choice,      cset,          alti;
Choices  =          a,          b,          c,          d;
Model:
U(a)=  csta*ATTB_A          +          cstb*ATTB_B          +
       cstc*ATTB_C          +          cstd*ATTB_D          +
       cste*ATTB_E          +          cstf*cost/
U(b)=  csta*ATTB_A          +          cstb*ATTB_B          +
       cstc*ATTB_C          +          cstd*ATTB_D          +
       cste*ATTB_E          +          cstf*cost/
U(c)=  csta*ATTB_A          +          cstb*ATTB_B          +
       cstc*ATTB_C          +          cstd*ATTB_D          +
       cste*ATTB_E          +          cstf*cost/
U(d)=  ascd;
LCM= LIVEWEN;
parameters;
pts=3;
Pds      =          8$;
Normal exit:  5 iterations. Status=0, F=          6169.598
-----+-----

```

```

--
Discrete choice (multinomial logit) model
Dependent variable          Choice
Log likelihood function      -6169.59788
Estimation based on N =     5168, K =     7
Inf.Cr.AIC = 12353.2 AIC/N =     2.390
Model estimated: Jul 02, 2020, 13:31:08
R2=1-LogL/LogL* Log-L fncn R-sqrd R2Adj
Constants only must be computed directly
          Use NLOGIT ;...;RHS=ONE$
Response data are given as ind. choices
Number of obs.=  5168, skipped    0 obs
-----+-----

```

```

--
          |          Standard          |          Prob.          |          95% Confidence
CHOICE| Coefficient          Error          z          |z|>Z*          Interval
-----+-----
CSTA|1|      1.50800***      .08136      18.53      .0000      1.34853      1.66747
CSTB|1|      .41312***      .08194      5.04      .0000      .25252      .57371
CSTC|1|      .27535***      .07945      3.47      .0005      .11963      .43107
CSTD|1|     -0.12704      .08524     -1.49      .1361     -0.29410      .04002
CSTE|1|      .25096***      .08053      3.12      .0018      .09312      .40881
CSTF|1|     -0.03814***      .00830     -4.59      .0000     -0.05442     -0.02187
ASCD|1|      .36529***      .12958      2.82      .0048      .11132      .61925

```

```

-----+-----
--
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
-----+-----
--

```

Normal exit: 54 iterations. Status=0, F= 5348.202

```

-----+-----
--
Latent Class Logit Model
Dependent variable          CHOICE
Log likelihood function     -5348.20201
Restricted log likelihood   -7164.36926
Chi squared [ 25 d.f.]     3632.33450
Significance level         .00000
McFadden Pseudo R-squared .2535000
Estimation based on N = 5168, K = 25
Inf.Cr.AIC = 10746.4 AIC/N = 2.079
Model estimated: Jul 02, 2020, 13:31:15
Constants only must be computed directly
                        Use NLOGIT ;...;RHS=ONE$
At start values -6169.6289 .1331*****
Response data are given as ind. choices
Number of latent classes = 3
Average Class Probabilities
                        .310 .414 .276
LCM model with panel has 646 groups
Fixed number of obsrvs./group= 8
Number of obs.= 5168, skipped 0 obs
-----+-----
--

```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
-----+-----						
Utility parameters in latent class -->> 1						
CSTA 1	.80130***	.15585	5.14	.0000	.49584	1.10677
CSTB 1	.98444***	.15804	6.23	.0000	.67468	1.29419
CSTC 1	1.06421***	.16454	6.47	.0000	.74172	1.38669
CSTD 1	.76658***	.17461	4.39	.0000	.42435	1.10882
CSTE 1	.84290***	.15626	5.39	.0000	.53664	1.14915
CSTF 1	-.07138***	.01645	-4.34	.0000	-.10361	-.03914
ASCD 1	-1.00398***	.30836	-3.26	.0011	-1.60836	-.39960
Utility parameters in latent class -->> 2						
CSTA 2	2.55712***	.21058	12.14	.0000	2.14439	2.96984
CSTB 2	-.06692	.20275	-.33	.7413	-.46431	.33047
CSTC 2	-.16101	.17757	-.91	.3645	-.50903	.18702
CSTD 2	-.72836***	.20285	-3.59	.0003	-1.12594	-.33079
CSTE 2	.10962	.18874	.58	.5614	-.26031	.47955
CSTF 2	.00037	.01996	.02	.9853	-.03875	.03949
ASCD 2	-.66049*	.34379	-1.92	.0547	-1.33432	.01333
Utility parameters in latent class -->> 3						
CSTA 3	1.87250***	.19503	9.60	.0000	1.49024	2.25476
CSTB 3	.22799	.18638	1.22	.2212	-.13730	.59329
CSTC 3	-.36741*	.19473	-1.89	.0592	-.74906	.01425
CSTD 3	-1.08724***	.20509	-5.30	.0000	-1.48921	-.68528
CSTE 3	-.58399***	.19488	-3.00	.0027	-.96595	-.20204
CSTF 3	-.07488***	.01824	-4.11	.0000	-.11062	-.03914
ASCD 3	.89814***	.30669	2.93	.0034	.29704	1.49923
This is THETA(01) in class probability model.						

```

Constant|      .19105      .12077      1.58  .1137      -.04566      .42775
_LIVEW|1|    -1.29943**    .53422      -2.43  .0150      -2.34648      -.25239
      |This is THETA(02) in class probability model.
Constant|      .44989***      .12088      3.72  .0002      .21297      .68681
_LIVEW|2|    -.59145      .40196      -1.47  .1412      -1.37927      .19637
      |This is THETA(03) in class probability model.
Constant|      0.0      .....(Fixed Parameter).....
_LIVEW|3|      0.0      .....(Fixed Parameter).....
-----+-----

```

```

--
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
Fixed parameter ... is constrained to equal the value or
had a nonpositive st.error because of an earlier problem.
-----+-----

```

```

|->
|-> Wald;
    Pts=1000;
    Labels =
    b1,    b2,        b3,        b4,        b5,        b6,        a1,
    c1,    c2,        c3,        c4,        c5,        c6,        a2,
    d1,    d2,        d3,        d4,        d5,        d6,        a3,
    e1,e2,e3,e4,e5,e6;
    Start =          b;
    Var    =          varb;
    Fn1    =          b1/b6;
    Fn2    =          b2/b6;
    Fn3    =          b3/b6;
    Fn4    =          b4/b6;
    Fn5    =          b5/b6;
    Fn6    =          c1/c6;
    Fn7    =          c2/c6;
    Fn8    =          c3/c6;
    Fn9    =          c4/c6;
    Fn10   =          c5/c6;
    Fn11   =          d1/d6;
    Fn12   =          d2/d6;
    Fn13   =          d3/d6;
    Fn14   =          d4/d6;
    Fn15   =          d5/d6$;

```

```

-----+-----
--
WALD procedure. Estimates and standard errors
for nonlinear functions and joint test of
nonlinear restrictions.

```

```

Wald Statistic          =      232.68772
Prob. from Chi-squared[15] =      .00000
Functions are computed at means of variables
-----+-----

```

```

--
      |          Standard      Prob.      95% Confidence
WaldFcns| Coefficient      Error      z      |z|>Z*      Interval
-----+-----
Fncn(1)|    -11.2264***      1.18772      -9.45  .0000      -13.5543      -8.8985
Fncn(2)|    -13.7921***      1.50826      -9.14  .0000      -16.7482     -10.8360
Fncn(3)|    -14.9097***      1.66467      -8.96  .0000      -18.1724     -11.6470
Fncn(4)|    -10.7399***      1.08255      -9.92  .0000      -12.8617      -8.6182
Fncn(5)|    -11.8091***      1.26316      -9.35  .0000      -14.2848     -9.3333

```

Fncn(6)		6941.71	376559.7	.02	.9853	-731101.75	744985.16
Fncn(7)		-181.673	9352.637	-.02	.9845	-18512.505	18149.159
Fncn(8)		-437.085	23256.83	-.02	.9850	-46019.625	45145.454
Fncn(9)		-1977.26	106630.0	-.02	.9852	-210968.12	207013.60
Fncn(10)		297.589	16582.96	.02	.9857	-32204.419	32799.598
Fncn(11)		-25.0075***	4.63070	-5.40	.0000	-34.0835	-15.9315
Fncn(12)		-3.04488	1.96849	-1.55	.1219	-6.90305	.81328
Fncn(13)		4.90678	3.59476	1.36	.1723	-2.13882	11.95238
Fncn(14)		14.5202**	5.86380	2.48	.0133	3.0274	26.0131
Fncn(15)		7.79930*	4.25717	1.83	.0669	-.54461	16.14321

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

```

|-> NLOGIT;
Lhs = choice, cset, alti;
Choices = a, b, c, d;
Model:
U(a)= csta*ATTB_A + cstb*ATTB_B +
      cstc*ATTB_C + cstd*ATTB_D +
      cste*ATTB_E + cstf*cost/
U(b)= csta*ATTB_A + cstb*ATTB_B +
      cstc*ATTB_C + cstd*ATTB_D +
      cste*ATTB_E + cstf*cost/
U(c)= csta*ATTB_A + cstb*ATTB_B +
      cstc*ATTB_C + cstd*ATTB_D +
      cste*ATTB_E + cstf*cost/
U(d)= ascd;
LCM= LIVEEMID;
parameters;
pts=3;
Pds = 8$;

```

Normal exit: 5 iterations. Status=0, F= 6169.598

```

Discrete choice (multinomial logit) model
Dependent variable Choice
Log likelihood function -6169.59788
Estimation based on N = 5168, K = 7
Inf.Cr.AIC = 12353.2 AIC/N = 2.390
Model estimated: Jul 02, 2020, 13:31:15
R2=1-LogL/LogL* Log-L fncn R-sqrd R2Adj
Constants only must be computed directly
Use NLOGIT ;...;RHS=ONE$
Response data are given as ind. choices
Number of obs.= 5168, skipped 0 obs

```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
CSTA 1	1.50800***	.08136	18.53	.0000	1.34853	1.66747
CSTB 1	.41312***	.08194	5.04	.0000	.25252	.57371
CSTC 1	.27535***	.07945	3.47	.0005	.11963	.43107
CSTD 1	-.12704	.08524	-1.49	.1361	-.29410	.04002
CSTE 1	.25096***	.08053	3.12	.0018	.09312	.40881
CSTF 1	-.03814***	.00830	-4.59	.0000	-.05442	-.02187

```

ASCD|1|      .36529***      .12958      2.82      .0048      .11132      .61925
-----+-----
--
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
-----+-----
--
Line search at iteration   50 does not improve fn. Exiting optimization.
-----+-----

```

```

--
Latent Class Logit Model
Dependent variable          CHOICE
Log likelihood function     -5351.59831
Restricted log likelihood   -7164.36926
Chi squared [ 25 d.f.]     3625.54189
Significance level         .00000
McFadden Pseudo R-squared  .2530259
Estimation based on N =   5168, K = 25
Inf.Cr.AIC = 10753.2 AIC/N = 2.081
Model estimated: Jul 02, 2020, 13:31:22
Constants only must be computed directly
                        Use NLOGIT ;...;RHS=ONE$
At start values -6169.6289 .1326*****
Response data are given as ind. choices
Number of latent classes = 3
Average Class Probabilities
      .310  .415  .275
LCM model with panel has 646 groups
Fixed number of obsrvs./group= 8
Number of obs.= 5168, skipped 0 obs
-----+-----

```

```

--
      |              Standard      Prob.      95% Confidence
CHOICE| Coefficient      Error      z      |z|>Z*      Interval
-----+-----
--
      |Utility parameters in latent class -->> 1
CSTA|1|      .81125***      .15618      5.19      .0000      .50515      1.11735
CSTB|1|      .98904***      .15755      6.28      .0000      .68025      1.29784
CSTC|1|      1.08059***      .16456      6.57      .0000      .75806      1.40312
CSTD|1|      .78381***      .17463      4.49      .0000      .44155      1.12608
CSTE|1|      .85632***      .15552      5.51      .0000      .55149      1.16114
CSTF|1|      -.07268***      .01645      -4.42      .0000      -.10491      -.04044
ASCD|1|      -.96351***      .30759      -3.13      .0017      -1.56637      -.36065
      |Utility parameters in latent class -->> 2
CSTA|2|      2.55685***      .20954      12.20      .0000      2.14617      2.96753
CSTB|2|      -.05668      .20103      -.28      .7780      -.45069      .33733
CSTC|2|      -.15886      .17705      -.90      .3696      -.50587      .18816
CSTD|2|      -.73200***      .20172      -3.63      .0003      -1.12737      -.33664
CSTE|2|      .11342      .18791      .60      .5461      -.25487      .48171
CSTF|2|      -.00011      .01985      -.01      .9956      -.03901      .03879
ASCD|2|      -.65313*      .34146      -1.91      .0558      -1.32237      .01611
      |Utility parameters in latent class -->> 3
CSTA|3|      1.86312***      .19632      9.49      .0000      1.47834      2.24790
CSTB|3|      .22152      .18725      1.18      .2368      -.14548      .58853
CSTC|3|      -.39126**      .19673      -1.99      .0467      -.77685      -.00568
CSTD|3|      -1.09869***      .20711      -5.30      .0000      -1.50462      -.69276
CSTE|3|      -.61204***      .19797      -3.09      .0020      -1.00006      -.22402
CSTF|3|      -.07339***      .01832      -4.01      .0001      -.10930      -.03748
ASCD|3|      .87929***      .31029      2.83      .0046      .27114      1.48745
-----+-----

```

```

      |This is THETA(01) in class probability model.
Constant|      .13724      .12064      1.14  .2553      -.09921      .37370
_LIVEE|1|     -.35818      .50176      -.71  .4753      -1.34162      .62526
      |This is THETA(02) in class probability model.
Constant|      .42271***      .12019      3.52  .0004      .18714      .65829
_LIVEE|2|     -.20000      .46354      -.43  .6661      -1.10852      .70853
      |This is THETA(03) in class probability model.
Constant|      0.0      .....(Fixed Parameter).....
_LIVEE|3|      0.0      .....(Fixed Parameter).....
-----+-----

```

```

--
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
Fixed parameter ... is constrained to equal the value or
had a nonpositive st.error because of an earlier problem.
-----+-----

```

```

|->
|-> Wald;
    Pts=1000;
    Labels =
    b1,    b2,        b3,        b4,        b5,        b6,        a1,
    c1,    c2,        c3,        c4,        c5,        c6,        a2,
    d1,    d2,        d3,        d4,        d5,        d6,        a3,
    e1,e2,e3,e4,e5,e6;
    Start =          b;
    Var    =          varb;
    Fn1    =          b1/b6;
    Fn2    =          b2/b6;
    Fn3    =          b3/b6;
    Fn4    =          b4/b6;
    Fn5    =          b5/b6;
    Fn6    =          c1/c6;
    Fn7    =          c2/c6;
    Fn8    =          c3/c6;
    Fn9    =          c4/c6;
    Fn10   =          c5/c6;
    Fn11   =          d1/d6;
    Fn12   =          d2/d6;
    Fn13   =          d3/d6;
    Fn14   =          d4/d6;
    Fn15   =          d5/d6$;

```

```

-----+-----
--
WALD procedure. Estimates and standard errors
for nonlinear functions and joint test of
nonlinear restrictions.

```

```

Wald Statistic          =      235.57398
Prob. from Chi-squared[15] =      .00000
Functions are computed at means of variables
-----+-----

```

```

-----+-----
--
      |          Standard      Prob.      95% Confidence
WaldFcns| Coefficient      Error      z      |z|>Z*      Interval
-----+-----
Fncn(1)|     -11.1623***      1.15594      -9.66  .0000      -13.4279      -8.8968
Fncn(2)|     -13.6088***      1.45240      -9.37  .0000      -16.4554     -10.7621
Fncn(3)|     -14.8684***      1.62822      -9.13  .0000      -18.0596     -11.6771
Fncn(4)|     -10.7849***      1.06870     -10.09  .0000      -12.8795      -8.6903

```



Fncn(5)		-11.7825***	1.22101	-9.65	.0000	-14.1756	-9.3893
Fncn(6)		-23436.9	.4263D+07	-.01	.9956	-8378620.3	8331746.5
Fncn(7)		519.513	96183.80	.01	.9957	-187997.265	189036.292
Fncn(8)		1456.12	266382.9	.01	.9956	-520644.70	523556.94
Fncn(9)		6709.77	.1223D+07	.01	.9956	-2389449.22	2402868.76
Fncn(10)		-1039.64	187626.3	-.01	.9956	-368780.34	366701.06
Fncn(11)		-25.3870***	4.84303	-5.24	.0000	-34.8791	-15.8948
Fncn(12)		-3.01850	2.02273	-1.49	.1356	-6.98299	.94598
Fncn(13)		5.33137	3.79234	1.41	.1598	-2.10147	12.76422
Fncn(14)		14.9709**	6.12973	2.44	.0146	2.9568	26.9849
Fncn(15)		8.33970*	4.51342	1.85	.0646	-.50644	17.18584

-----+-----  
--  
Note: nnnnn.D-xx or D+xx => multiply by 10 to -xx or +xx.  
Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.  
-----+-----  
--

```
|-> NLOGIT;
  Lhs      =          choice,      cset,      alti;
  Choices   =          a,          b,          c,          d;
  Model:
  U(a)=  csta*ATTB_A      +          cstb*ATTB_B      +
         cstc*ATTB_C      +          cstd*ATTB_D      +
         cste*ATTB_E      +          cstf*cost/
  U(b)=  csta*ATTB_A      +          cstb*ATTB_B      +
         cstc*ATTB_C      +          cstd*ATTB_D      +
         cste*ATTB_E      +          cstf*cost/
  U(c)=  csta*ATTB_A      +          cstb*ATTB_B      +
         cstc*ATTB_C      +          cstd*ATTB_D      +
         cste*ATTB_E      +          cstf*cost/
  U(d)=  ascd;
  LCM= LIVEYHUM;
  parameters;
  pts=3;
  Pds      =          8$;
Normal exit:  5 iterations. Status=0, F=          6169.598
```

-----+-----  
--  
Discrete choice (multinomial logit) model  
Dependent variable Choice  
Log likelihood function -6169.59788  
Estimation based on N = 5168, K = 7  
Inf.Cr.AIC = 12353.2 AIC/N = 2.390  
Model estimated: Jul 02, 2020, 13:31:22  
R2=1-LogL/LogL\* Log-L fncn R-sqrd R2Adj  
Constants only must be computed directly  
Use NLOGIT ;...;RHS=ONE\$  
Response data are given as ind. choices  
Number of obs.= 5168, skipped 0 obs  
-----+-----  
--

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
CSTA 1	1.50800***	.08136	18.53	.0000	1.34853	1.66747
CSTB 1	.41312***	.08194	5.04	.0000	.25252	.57371
CSTC 1	.27535***	.07945	3.47	.0005	.11963	.43107
CSTD 1	-.12704	.08524	-1.49	.1361	-.29410	.04002

```

CSTE|1|      .25096***      .08053      3.12      .0018      .09312      .40881
CSTF|1|     -.03814***      .00830     -4.59      .0000     -.05442     -.02187
ASCD|1|      .36529***      .12958      2.82      .0048      .11132      .61925

```

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

Line search at iteration 50 does not improve fn. Exiting optimization.  
Error: 1027: Models - estimated variance matrix of estimates is singular  
Error: 1027: Models - estimated variance matrix of estimates is singular

```

|->
|-> Wald;
    Pts=1000;
    Labels =
    b1,    b2,    b3,    b4,    b5,    b6,    a1,
    c1,    c2,    c3,    c4,    c5,    c6,    a2,
    d1,    d2,    d3,    d4,    d5,    d6,    a3,
    e1,e2,e3,e4,e5,e6;
    Start =      b;
    Var    =      varb;
    Fn1    =      b1/b6;
    Fn2    =      b2/b6;
    Fn3    =      b3/b6;
    Fn4    =      b4/b6;
    Fn5    =      b5/b6;
    Fn6    =      c1/c6;
    Fn7    =      c2/c6;
    Fn8    =      c3/c6;
    Fn9    =      c4/c6;
    Fn10   =      c5/c6;
    Fn11   =      d1/d6;
    Fn12   =      d2/d6;
    Fn13   =      d3/d6;
    Fn14   =      d4/d6;
    Fn15   =      d5/d6$;

```

WALD procedure. Estimates and standard errors for nonlinear functions and joint test of nonlinear restrictions.

```

Wald Statistic      =      235.57398
Prob. from Chi-squared[15] =      .00000
Functions are computed at means of variables

```

WaldFcns	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Fncn(1)	-11.1623***	1.15594	-9.66	.0000	-13.4279	-8.8968
Fncn(2)	-13.6088***	1.45240	-9.37	.0000	-16.4554	-10.7621
Fncn(3)	-14.8684***	1.62822	-9.13	.0000	-18.0596	-11.6771
Fncn(4)	-10.7849***	1.06870	-10.09	.0000	-12.8795	-8.6903
Fncn(5)	-11.7825***	1.22101	-9.65	.0000	-14.1756	-9.3893
Fncn(6)	-23436.9	.4263D+07	-.01	.9956	-8378620.3	8331746.5
Fncn(7)	519.513	96183.80	.01	.9957	-187997.265	189036.292
Fncn(8)	1456.12	266382.9	.01	.9956	-520644.70	523556.94
Fncn(9)	6709.77	.1223D+07	.01	.9956	-2389449.22	2402868.76

```

Fncn(10) | -1039.64      187626.3      -.01   .9956  -368780.34  366701.06
Fncn(11) | -25.3870***     4.84303     -5.24  .0000   -34.8791  -15.8948
Fncn(12) | -3.01850        2.02273     -1.49  .1356   -6.98299   .94598
Fncn(13) |  5.33137        3.79234      1.41  .1598   -2.10147  12.76422
Fncn(14) | 14.9709**       6.12973      2.44  .0146    2.9568   26.9849
Fncn(15) |  8.33970*       4.51342      1.85  .0646   - .50644  17.18584
-----+-----

```

```

--
Note: nnnnn.D-xx or D+xx => multiply by 10 to -xx or +xx.
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
-----+-----
--

```

```

|-> NLOGIT;
Lhs      =          choice,   cset,      alti;
Choices  =          a,       b,          c,          d;
Model:
U(a)=  csta*ATTB_A          +          cstb*ATTB_B          +
       cstc*ATTB_C          +          cstd*ATTB_D          +
       cste*ATTB_E          +          cstf*cost/
U(b)=  csta*ATTB_A          +          cstb*ATTB_B          +
       cstc*ATTB_C          +          cstd*ATTB_D          +
       cste*ATTB_E          +          cstf*cost/
U(c)=  csta*ATTB_A          +          cstb*ATTB_B          +
       cstc*ATTB_C          +          cstd*ATTB_D          +
       cste*ATTB_E          +          cstf*cost/
U(d)=  ascd;
LCM= LIVENEEN;
parameters;
pts=3;
Pds      =          8$;
Normal exit:  5 iterations. Status=0, F=          6169.598
-----+-----

```

```

--
Discrete choice (multinomial logit) model
Dependent variable          Choice
Log likelihood function      -6169.59788
Estimation based on N =    5168, K =    7
Inf.Cr.AIC = 12353.2 AIC/N =    2.390
Model estimated: Jul 02, 2020, 13:31:30
R2=1-LogL/LogL* Log-L fncn R-sqrd R2Adj
Constants only must be computed directly
Use NLOGIT ;...;RHS=ONE$
Response data are given as ind. choices
Number of obs.= 5168, skipped    0 obs
-----+-----

```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
CSTA 1	1.50800***	.08136	18.53	.0000	1.34853	1.66747
CSTB 1	.41312***	.08194	5.04	.0000	.25252	.57371
CSTC 1	.27535***	.07945	3.47	.0005	.11963	.43107
CSTD 1	-.12704	.08524	-1.49	.1361	-.29410	.04002
CSTE 1	.25096***	.08053	3.12	.0018	.09312	.40881
CSTF 1	-.03814***	.00830	-4.59	.0000	-.05442	-.02187
ASCD 1	.36529***	.12958	2.82	.0048	.11132	.61925

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

-----  
--

Line search at iteration 50 does not improve fn. Exiting optimization.

-----  
--

```
Latent Class Logit Model
Dependent variable          CHOICE
Log likelihood function     -5351.27287
Restricted log likelihood   -7164.36926
Chi squared [ 25 d.f.]     3626.19277
Significance level         .00000
McFadden Pseudo R-squared  .2530713
Estimation based on N = 5168, K = 25
Inf.Cr.AIC = 10752.5 AIC/N = 2.081
Model estimated: Jul 02, 2020, 13:31:36
Constants only must be computed directly
                        Use NLOGIT ;...;RHS=ONE$
At start values -6169.6289 .1326*****
Response data are given as ind. choices
Number of latent classes = 3
Average Class Probabilities
                        .309 .415 .276
LCM model with panel has 646 groups
Fixed number of obsrvs./group= 8
Number of obs.= 5168, skipped 0 obs
```

-----+-----  
--

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
--------	-------------	----------------	---	--------------	-------------------------	--

-----+-----  
--

```
|Utility parameters in latent class -->> 1
CSTA|1| .80953*** .15616 5.18 .0000 .50345 1.11560
CSTB|1| .98970*** .15763 6.28 .0000 .68075 1.29864
CSTC|1| 1.07941*** .16426 6.57 .0000 .75747 1.40134
CSTD|1| .78338*** .17437 4.49 .0000 .44162 1.12514
CSTE|1| .85534*** .15555 5.50 .0000 .55046 1.16022
CSTF|1| -.07259*** .01645 -4.41 .0000 -.10483 -.04035
ASCD|1| -.96510*** .30795 -3.13 .0017 -1.56867 -.36152
|Utility parameters in latent class -->> 2
CSTA|2| 2.55555*** .20923 12.21 .0000 2.14548 2.96563
CSTB|2| -.06172 .20162 -.31 .7595 -.45689 .33345
CSTC|2| -.15921 .17723 -.90 .3690 -.50659 .18816
CSTD|2| -.73035*** .20212 -3.61 .0003 -1.12650 -.33420
CSTE|2| .11633 .18814 .62 .5364 -.25242 .48508
CSTF|2| .62432D-04 .01989 .00 .9975 -.38918D-01 .39043D-01
ASCD|2| -.65882* .34198 -1.93 .0540 -1.32909 .01145
|Utility parameters in latent class -->> 3
CSTA|3| 1.86541*** .19499 9.57 .0000 1.48323 2.24758
CSTB|3| .22705 .18678 1.22 .2241 -.13904 .59314
CSTC|3| -.38490** .19613 -1.96 .0497 -.76930 -.00049
CSTD|3| -1.09955*** .20556 -5.35 .0000 -1.50244 -.69666
CSTE|3| -.61096*** .19646 -3.11 .0019 -.99601 -.22591
CSTF|3| -.07357*** .01830 -4.02 .0001 -.10943 -.03771
ASCD|3| .88152*** .30680 2.87 .0041 .28019 1.48285
|This is THETA(01) in class probability model.
Constant| .12948 .12070 1.07 .2834 -.10708 .36604
_LIVEN|1| -.34848 .55501 -.63 .5301 -1.43628 .73932
```

```

      |This is THETA(02) in class probability model.
Constant|      .43168***      .11904      3.63      .0003      .19836      .66500
_LIVEN|2|      -.60557      .56801      -1.07      .2864      -1.71884      .50771

```

```

      |This is THETA(03) in class probability model.
Constant|      0.0      .....(Fixed Parameter).....
_LIVEN|3|      0.0      .....(Fixed Parameter).....

```

```

-----+-----
--
Note: nnnnn.D-xx or D+xx => multiply by 10 to -xx or +xx.
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
Fixed parameter ... is constrained to equal the value or
had a nonpositive st.error because of an earlier problem.
-----+-----
--

```

```

|->
|-> Wald;
    Pts=1000;
    Labels =
    b1,    b2,        b3,        b4,        b5,        b6,        a1,
    c1,    c2,        c3,        c4,        c5,        c6,        a2,
    d1,    d2,        d3,        d4,        d5,        d6,        a3,
    e1,e2,e3,e4,e5,e6;
    Start =          b;
    Var    =          varb;
    Fn1    =          b1/b6;
    Fn2    =          b2/b6;
    Fn3    =          b3/b6;
    Fn4    =          b4/b6;
    Fn5    =          b5/b6;
    Fn6    =          c1/c6;
    Fn7    =          c2/c6;
    Fn8    =          c3/c6;
    Fn9    =          c4/c6;
    Fn10   =          c5/c6;
    Fn11   =          d1/d6;
    Fn12   =          d2/d6;
    Fn13   =          d3/d6;
    Fn14   =          d4/d6;
    Fn15   =          d5/d6$;

```

```

-----+-----
--
WALD procedure. Estimates and standard errors
for nonlinear functions and joint test of
nonlinear restrictions.

```

```

Wald Statistic          =      236.88769
Prob. from Chi-squared[15] =      .00000
Functions are computed at means of variables
-----+-----
--

```

	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Fncn(1)	-11.1527***	1.15634	-9.64	.0000	-13.4191	-8.8863
Fncn(2)	-13.6349***	1.45753	-9.35	.0000	-16.4916	-10.7782
Fncn(3)	-14.8708***	1.63916	-9.07	.0000	-18.0835	-11.6581
Fncn(4)	-10.7925***	1.07298	-10.06	.0000	-12.8955	-8.6895
Fncn(5)	-11.7839***	1.22911	-9.59	.0000	-14.1929	-9.3749
Fncn(6)	40933.7	.1305D+08	.00	.9975	-25528706.4	25610573.8

Fncn(7)		-988.581	312111.9	.00	.9975	-612716.720	610739.558
Fncn(8)		-2550.21	810104.3	.00	.9975	-1590325.44	1585225.01
Fncn(9)		-11698.3	.3725D+07	.00	.9975	-7311932.6	7288535.9
Fncn(10)		1863.35	596447.0	.00	.9975	-1167151.34	1170878.04
Fncn(11)		-25.3553***	4.82130	-5.26	.0000	-34.8048	-15.9057
Fncn(12)		-3.08617	2.00197	-1.54	.1232	-7.00995	.83762
Fncn(13)		5.23168	3.75201	1.39	.1632	-2.12212	12.58548
Fncn(14)		14.9455**	6.08665	2.46	.0141	3.0159	26.8751
Fncn(15)		8.30439*	4.47213	1.86	.0633	-.46082	17.06961

--  
Note: nnnnn.D-xx or D+xx => multiply by 10 to -xx or +xx.  
Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

```

|-> NLOGIT;
Lhs = choice, cset, alti;
Choices = a, b, c, d;
Model:
U(a)= csta*ATTB_A + cstab*ATTB_B +
      cstc*ATTB_C + cstd*ATTB_D +
      cste*ATTB_E + cstf*cost/
U(b)= csta*ATTB_A + cstab*ATTB_B +
      cstc*ATTB_C + cstd*ATTB_D +
      cste*ATTB_E + cstf*cost/
U(c)= csta*ATTB_A + cstab*ATTB_B +
      cstc*ATTB_C + cstd*ATTB_D +
      cste*ATTB_E + cstf*cost/
U(d)= ascd;
LCM= GENBLANK;
parameters;
pts=3;
Pds = 8$;

```

Normal exit: 5 iterations. Status=0, F= 6169.598

-----  
--  
Discrete choice (multinomial logit) model  
Dependent variable Choice  
Log likelihood function -6169.59788  
Estimation based on N = 5168, K = 7  
Inf.Cr.AIC = 12353.2 AIC/N = 2.390  
Model estimated: Jul 02, 2020, 13:31:37  
R2=1-LogL/LogL\* Log-L fncn R-sqrd R2Adj  
Constants only must be computed directly  
Use NLOGIT ;...;RHS=ONE\$  
Response data are given as ind. choices  
Number of obs.= 5168, skipped 0 obs

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
CSTA 1	1.50800***	.08136	18.53	.0000	1.34853	1.66747
CSTB 1	.41312***	.08194	5.04	.0000	.25252	.57371
CSTC 1	.27535***	.07945	3.47	.0005	.11963	.43107
CSTD 1	-.12704	.08524	-1.49	.1361	-.29410	.04002
CSTE 1	.25096***	.08053	3.12	.0018	.09312	.40881
CSTF 1	-.03814***	.00830	-4.59	.0000	-.05442	-.02187

```

ASCD|1|      .36529***      .12958      2.82      .0048      .11132      .61925
-----+-----

```

```

--
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
-----+-----

```

```

--
Line search at iteration 51 does not improve fn. Exiting optimization.
-----+-----

```

```

--
Latent Class Logit Model
Dependent variable          CHOICE
Log likelihood function     -5348.81633
Restricted log likelihood   -7164.36926
Chi squared [ 25 d.f.]     3631.10585
Significance level         .00000
McFadden Pseudo R-squared  .2534142
Estimation based on N = 5168, K = 25
Inf.Cr.AIC = 10747.6 AIC/N = 2.080
Model estimated: Jul 02, 2020, 13:31:44
Constants only must be computed directly
                        Use NLOGIT ;...;RHS=ONE$
At start values -6169.6289 .1330*****
Response data are given as ind. choices
Number of latent classes = 3
Average Class Probabilities
      .310 .417 .273
LCM model with panel has 646 groups
Fixed number of obsrvs./group= 8
Number of obs.= 5168, skipped 0 obs
-----+-----

```

```

--
      |              Standard      Prob.      95% Confidence
CHOICE| Coefficient      Error      z      |z|>Z*      Interval
-----+-----
      |
      |Utility parameters in latent class -->> 1
CSTA|1|      .81410***      .15570      5.23      .0000      .50893      1.11926
CSTB|1|      .99004***      .15691      6.31      .0000      .68250      1.29758
CSTC|1|      1.08085***      .16404      6.59      .0000      .75933      1.40236
CSTD|1|      .78772***      .17472      4.51      .0000      .44528      1.13016
CSTE|1|      .86082***      .15558      5.53      .0000      .55588      1.16576
CSTF|1|      -.07305***      .01641      -4.45      .0000      -.10521      -.04090
ASCD|1|      -.96263***      .30708      -3.13      .0017      -1.56450      -.36077
      |
      |Utility parameters in latent class -->> 2
CSTA|2|      2.55427***      .20787      12.29      .0000      2.14685      2.96169
CSTB|2|      -.05036      .20058      -.25      .8018      -.44349      .34278
CSTC|2|      -.15568      .17635      -.88      .3773      -.50132      .18995
CSTD|2|      -.73378***      .20021      -3.66      .0002      -1.12619      -.34137
CSTE|2|      .10733      .18702      .57      .5661      -.25922      .47387
CSTF|2|      -.00033      .01977      -.02      .9866      -.03908      .03841
ASCD|2|      -.63140*      .33821      -1.87      .0619      -1.29427      .03147
      |
      |Utility parameters in latent class -->> 3
CSTA|3|      1.86067***      .19679      9.45      .0000      1.47496      2.24638
CSTB|3|      .21955      .18789      1.17      .2426      -.14870      .58780
CSTC|3|      -.39702**      .19760      -2.01      .0445      -.78430      -.00973
CSTD|3|      -1.10055***      .20730      -5.31      .0000      -1.50685      -.69425
CSTE|3|      -.61876***      .19732      -3.14      .0017      -1.00550      -.23202
CSTF|3|      -.07348***      .01841      -3.99      .0001      -.10957      -.03739
ASCD|3|      .88066***      .30939      2.85      .0044      .27426      1.48705

```

```

      |This is THETA(01) in class probability model.
Constant|   .13876   .12063   1.15 .2500   -.09766   .37519
_GENBL|1|  -.16342   .44408   -.37 .7129   -1.03380   .70696
      |This is THETA(02) in class probability model.
Constant|   .47980***   .11826   4.06 .0000   .24803   .71158
_GENBL|2|  -1.11305**   .52483   -2.12 .0339   -2.14169   -.08441
      |This is THETA(03) in class probability model.
Constant|   0.0   .....(Fixed Parameter).....
_GENBL|3|   0.0   .....(Fixed Parameter).....
-----+-----

```

```

--
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
Fixed parameter ... is constrained to equal the value or
had a nonpositive st.error because of an earlier problem.
-----+-----

```

```

|->
|-> Wald;
    Pts=1000;
    Labels =
    b1,    b2,        b3,        b4,        b5,        b6,        a1,
    c1,    c2,        c3,        c4,        c5,        c6,        a2,
    d1,    d2,        d3,        d4,        d5,        d6,        a3,
    e1,e2,e3,e4,e5,e6;
    Start =          b;
    Var    =          varb;
    Fn1    =          b1/b6;
    Fn2    =          b2/b6;
    Fn3    =          b3/b6;
    Fn4    =          b4/b6;
    Fn5    =          b5/b6;
    Fn6    =          c1/c6;
    Fn7    =          c2/c6;
    Fn8    =          c3/c6;
    Fn9    =          c4/c6;
    Fn10   =          c5/c6;
    Fn11   =          d1/d6;
    Fn12   =          d2/d6;
    Fn13   =          d3/d6;
    Fn14   =          d4/d6;
    Fn15   =          d5/d6$;

```

```

--
WALD procedure. Estimates and standard errors
for nonlinear functions and joint test of
nonlinear restrictions.

```

```

Wald Statistic          =      238.69100
Prob. from Chi-squared[15] =      .00000
Functions are computed at means of variables
-----+-----

```

	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Fncn(1)	-11.1441***	1.14385	-9.74	.0000	-13.3861	-8.9022
Fncn(2)	-13.5527***	1.43075	-9.47	.0000	-16.3569	-10.7485
Fncn(3)	-14.7957***	1.59899	-9.25	.0000	-17.9297	-11.6617
Fncn(4)	-10.7831***	1.07570	-10.02	.0000	-12.8914	-8.6748



Fncn(5)		-11.7837***	1.22043	-9.66	.0000	-14.1757	-9.3917
Fncn(6)		-7683.04	456370.2	-.02	.9866	-902152.15	886786.06
Fncn(7)		151.465	9551.415	.02	.9873	-18568.965	18871.895
Fncn(8)		468.280	28315.28	.02	.9868	-55028.651	55965.210
Fncn(9)		2207.14	131792.0	.02	.9866	-256100.52	260514.80
Fncn(10)		-322.825	18694.62	-.02	.9862	-36963.613	36317.962
Fncn(11)		-25.3225***	4.84271	-5.23	.0000	-34.8140	-15.8309
Fncn(12)		-2.98794	2.03433	-1.47	.1419	-6.97516	.99928
Fncn(13)		5.40318	3.81948	1.41	.1572	-2.08286	12.88922
Fncn(14)		14.9778**	6.13978	2.44	.0147	2.9441	27.0116
Fncn(15)		8.42091*	4.52646	1.86	.0628	-.45080	17.29261

-----+-----  
--  
Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.  
-----+-----  
--

```
|-> NLOGIT;
Lhs = choice, cset, alti;
Choices = a, b, c, d;
Model:
U(a)= csta*ATTB_A + cstab*ATTB_B +
      cstc*ATTB_C + cstd*ATTB_D +
      cste*ATTB_E + cstf*cost/
U(b)= csta*ATTB_A + cstab*ATTB_B +
      cstc*ATTB_C + cstd*ATTB_D +
      cste*ATTB_E + cstf*cost/
U(c)= csta*ATTB_A + cstab*ATTB_B +
      cstc*ATTB_C + cstd*ATTB_D +
      cste*ATTB_E + cstf*cost/
U(d)= ascd;
LCM= GENPNTS;
parameters;
pts=3;
Pds = 8$;
Normal exit: 5 iterations. Status=0, F= 6169.598
```

-----+-----  
--  
Discrete choice (multinomial logit) model  
Dependent variable Choice  
Log likelihood function -6169.59788  
Estimation based on N = 5168, K = 7  
Inf.Cr.AIC = 12353.2 AIC/N = 2.390  
Model estimated: Jul 02, 2020, 13:31:45  
R2=1-LogL/LogL\* Log-L fncn R-sqrd R2Adj  
Constants only must be computed directly  
Use NLOGIT ;...;RHS=ONE\$  
Response data are given as ind. choices  
Number of obs.= 5168, skipped 0 obs  
-----+-----  
--

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
CSTA 1	1.50800***	.08136	18.53	.0000	1.34853	1.66747
CSTB 1	.41312***	.08194	5.04	.0000	.25252	.57371
CSTC 1	.27535***	.07945	3.47	.0005	.11963	.43107
CSTD 1	-.12704	.08524	-1.49	.1361	-.29410	.04002
CSTE 1	.25096***	.08053	3.12	.0018	.09312	.40881

```

CSTF|1|    -.03814***    .00830    -4.59    .0000    -.05442    -.02187
ASCD|1|    .36529***    .12958    2.82    .0048    .11132    .61925

```

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

Line search at iteration 50 does not improve fn. Exiting optimization.

```

Latent Class Logit Model
Dependent variable          CHOICE
Log likelihood function     -5348.44479
Restricted log likelihood   -7164.36926
Chi squared [ 25 d.f.]     3631.84894
Significance level         .00000
McFadden Pseudo R-squared  .2534661
Estimation based on N =   5168, K = 25
Inf.Cr.AIC = 10746.9 AIC/N = 2.080
Model estimated: Jul 02, 2020, 13:31:51
Constants only must be computed directly
                        Use NLOGIT ;...;RHS=ONE$
At start values -6169.6289 .1331*****
Response data are given as ind. choices
Number of latent classes = 3
Average Class Probabilities
    .309 .416 .276
LCM model with panel has 646 groups
Fixed number of obsrvs./group= 8
Number of obs.= 5168, skipped 0 obs

```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval
--------	-------------	----------------	---	--------------	-------------------------

```

|Utility parameters in latent class -->> 1
CSTA|1|    .80879***    .15731    5.14    .0000    .50046    1.11711
CSTB|1|    .99000***    .15872    6.24    .0000    .67891    1.30109
CSTC|1|    1.07666***    .16604    6.48    .0000    .75122    1.40210
CSTD|1|    .78758***    .17625    4.47    .0000    .44214    1.13303
CSTE|1|    .85599***    .15694    5.45    .0000    .54838    1.16359
CSTF|1|    -.07264***    .01663    -4.37    .0000    -.10523    -.04005
ASCD|1|    -.97163***    .30963    -3.14    .0017    -1.57850    -.36477
|Utility parameters in latent class -->> 2
CSTA|2|    2.54930***    .20922    12.19    .0000    2.13925    2.95936
CSTB|2|    -.06230    .20126    -.31    .7569    -.45677    .33217
CSTC|2|    -.15910    .17727    -.90    .3694    -.50654    .18834
CSTD|2|    -.73866***    .20248    -3.65    .0003    -1.13551    -.34182
CSTE|2|    .10910    .18784    .58    .5614    -.25906    .47726
CSTF|2|    .00063    .01987    .03    .9746    -.03832    .03959
ASCD|2|    -.65921*    .34213    -1.93    .0540    -1.32976    .01135
|Utility parameters in latent class -->> 3
CSTA|3|    1.85704***    .19659    9.45    .0000    1.47174    2.24235
CSTB|3|    .21905    .18849    1.16    .2452    -.15038    .58849
CSTC|3|    -.38502**    .19615    -1.96    .0497    -.76946    -.00058
CSTD|3|    -1.10073***    .20590    -5.35    .0000    -1.50430    -.69717
CSTE|3|    -.60994***    .19626    -3.11    .0019    -.99460    -.22528
CSTF|3|    -.07337***    .01845    -3.98    .0001    -.10953    -.03722

```

```

ASCD|3|      .87260***      .30680      2.84 .0045      .27128      1.47391
      |This is THETA(01) in class probability model.
Constant|      .16994      .11982      1.42 .1561      -.06491      .40478
_GENPN|1|     -1.58630**      .75431      -2.10 .0355      -3.06473      -.10788
      |This is THETA(02) in class probability model.
Constant|      .45151***      .11909      3.79 .0001      .21809      .68492
_GENPN|2|     -.84790      .54065      -1.57 .1168      -1.90755      .21175
      |This is THETA(03) in class probability model.
Constant|      0.0      .....(Fixed Parameter).....
_GENPN|3|      0.0      .....(Fixed Parameter).....
-----+-----

```

```

--
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
Fixed parameter ... is constrained to equal the value or
had a nonpositive st.error because of an earlier problem.
-----+-----

```

```

|->
|-> Wald;
    Pts=1000;
    Labels =
    b1,    b2,    b3,    b4,    b5,    b6,    a1,
    c1,    c2,    c3,    c4,    c5,    c6,    a2,
    d1,    d2,    d3,    d4,    d5,    d6,    a3,
    e1,e2,e3,e4,e5,e6;
    Start =      b;
    Var =      varb;
    Fn1 =      b1/b6;
    Fn2 =      b2/b6;
    Fn3 =      b3/b6;
    Fn4 =      b4/b6;
    Fn5 =      b5/b6;
    Fn6 =      c1/c6;
    Fn7 =      c2/c6;
    Fn8 =      c3/c6;
    Fn9 =      c4/c6;
    Fn10 =     c5/c6;
    Fn11 =     d1/d6;
    Fn12 =     d2/d6;
    Fn13 =     d3/d6;
    Fn14 =     d4/d6;
    Fn15 =     d5/d6$;

```

```

--
WALD procedure. Estimates and standard errors
for nonlinear functions and joint test of
nonlinear restrictions.

```

```

Wald Statistic      =      234.25437
Prob. from Chi-squared[15] =      .00000
Functions are computed at means of variables
-----+-----

```

```

--
      |      Standard      Prob.      95% Confidence
WaldFcns| Coefficient      Error      z      |z|>Z*      Interval
-----+-----
--
Fncn(1)|     -11.1336***      1.15843      -9.61 .0000      -13.4041      -8.8631
Fncn(2)|     -13.6281***      1.46265      -9.32 .0000      -16.4948     -10.7614
Fncn(3)|     -14.8211***      1.62841      -9.10 .0000     -18.0127     -11.6294

```

Fncn(4)		-10.8417***	1.07187	-10.11	.0000	-12.9425	-8.7409
Fncn(5)		-11.7833***	1.22953	-9.58	.0000	-14.1932	-9.3735
Fncn(6)		4025.61	126597.9	.03	.9746	-244101.71	252152.93
Fncn(7)		-98.3824	2806.085	-.04	.9720	-5598.2071	5401.4423
Fncn(8)		-251.236	7638.488	-.03	.9738	-15222.398	14719.927
Fncn(9)		-1166.42	36316.27	-.03	.9744	-72345.00	70012.16
Fncn(10)		172.280	5673.839	.03	.9758	-10948.239	11292.800
Fncn(11)		-25.3091***	4.84031	-5.23	.0000	-34.7959	-15.8222
Fncn(12)		-2.98542	2.03875	-1.46	.1431	-6.98130	1.01046
Fncn(13)		5.24731	3.76982	1.39	.1639	-2.14141	12.63602
Fncn(14)		15.0016**	6.12610	2.45	.0143	2.9946	27.0085
Fncn(15)		8.31271*	4.50220	1.85	.0648	-.51144	17.13686

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

```

|-> NLOGIT;
  Lhs      =          choice,      cset,      alti;
  Choices      =          a,          b,          c,          d;
  Model:
  U(a)=  csta*ATTB_A      +          cstb*ATTB_B      +
         cstc*ATTB_C      +          cstd*ATTB_D      +
         cste*ATTB_E      +          cstf*cost/
  U(b)=  csta*ATTB_A      +          cstb*ATTB_B      +
         cstc*ATTB_C      +          cstd*ATTB_D      +
         cste*ATTB_E      +          cstf*cost/
  U(c)=  csta*ATTB_A      +          cstb*ATTB_B      +
         cstc*ATTB_C      +          cstd*ATTB_D      +
         cste*ATTB_E      +          cstf*cost/
  U(d)=  ascd;
  LCM= GENNL;
  parameters;
  pts=3;
  Pds      =          8$;

```

Normal exit: 5 iterations. Status=0, F= 6169.598

```

Discrete choice (multinomial logit) model
Dependent variable      Choice
Log likelihood function -6169.59788
Estimation based on N = 5168, K = 7
Inf.Cr.AIC = 12353.2 AIC/N = 2.390
Model estimated: Jul 02, 2020, 13:31:52
R2=1-LogL/LogL* Log-L fncn R-sqrd R2Adj
Constants only must be computed directly
Use NLOGIT ;...;RHS=ONE$
Response data are given as ind. choices
Number of obs.= 5168, skipped 0 obs

```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
CSTA 1	1.50800***	.08136	18.53	.0000	1.34853	1.66747
CSTB 1	.41312***	.08194	5.04	.0000	.25252	.57371
CSTC 1	.27535***	.07945	3.47	.0005	.11963	.43107
CSTD 1	-.12704	.08524	-1.49	.1361	-.29410	.04002

```

CSTE|1|      .25096***      .08053      3.12      .0018      .09312      .40881
CSTF|1|     -.03814***      .00830     -4.59      .0000     -.05442     -.02187
ASCD|1|      .36529***      .12958      2.82      .0048      .11132      .61925
-----+-----
--
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
-----+-----
--
Line search at iteration 52 does not improve fn. Exiting optimization.
-----+-----
--
Latent Class Logit Model
Dependent variable          CHOICE
Log likelihood function     -5351.78175
Restricted log likelihood   -7164.36926
Chi squared [ 25 d.f.]     3625.17502
Significance level         .00000
McFadden Pseudo R-squared  .2530003
Estimation based on N =   5168, K = 25
Inf.Cr.AIC = 10753.6 AIC/N = 2.081
Model estimated: Jul 02, 2020, 13:31:59
Constants only must be computed directly
      Use NLOGIT ;...;RHS=ONE$
At start values -6169.6289 .1326*****
Response data are given as ind. choices
Number of latent classes = 3
Average Class Probabilities
      .310 .415 .275
LCM model with panel has 646 groups
Fixed number of obsrvs./group= 8
Number of obs.= 5168, skipped 0 obs
-----+-----
--
      |
      | CHOICE| Coefficient      Standard      Prob.      95% Confidence
      |      |      Error      z      |z|>Z*      Interval
      |-----+-----
--
      | Utility parameters in latent class -->> 1
CSTA|1|      .81021***      .15744      5.15      .0000      .50163      1.11879
CSTB|1|      .98862***      .15932      6.21      .0000      .67635      1.30088
CSTC|1|      1.07891***      .16553      6.52      .0000      .75447      1.40335
CSTD|1|      .78272***      .17557      4.46      .0000      .43859      1.12684
CSTE|1|      .85496***      .15637      5.47      .0000      .54849      1.16143
CSTF|1|     -.07255***      .01659     -4.37      .0000     -.10508     -.04003
ASCD|1|     -.96350***      .31163     -3.09      .0020     -1.57429     -.35272
      | Utility parameters in latent class -->> 2
CSTA|2|      2.55421***      .20957     12.19      .0000      2.14346      2.96495
CSTB|2|     -.05836      .20127     -.29      .7718     -.45285      .33613
CSTC|2|     -.15948      .17722     -.90      .3682     -.50682      .18786
CSTD|2|     -.73270***      .20198     -3.63      .0003     -1.12856     -.33683
CSTE|2|      .11265      .18814      .60      .5493     -.25609      .48138
CSTF|2|     .94087D-05      .01987      .00      .9996     -.38928D-01      .38947D-01
ASCD|2|     -.65684*      .34151     -1.92      .0544     -1.32619      .01252
      | Utility parameters in latent class -->> 3
CSTA|3|      1.86482***      .19533      9.55      .0000      1.48197      2.24766
CSTB|3|      .22129      .18721      1.18      .2372     -.14564      .58822
CSTC|3|     -.39021**      .19679     -1.98      .0474     -.77591     -.00451
CSTD|3|     -1.09947***      .20624     -5.33      .0000     -1.50370     -.69525
CSTE|3|     -.61180***      .19640     -3.12      .0018     -.99673     -.22687

```

```

CSTF|3|    -.07339***    .01836    -4.00    .0001    -.10937    -.03741
ASCD|3|    .88151***    .30704    2.87    .0041    .27973    1.48329
      |This is THETA(01) in class probability model.
Constant|    .11208    .12084    .93    .3536    -.12475    .34891
_GENNL|1|    .11888    .51269    .23    .8166    -.88598    1.12374
      |This is THETA(02) in class probability model.
Constant|    .40147***    .12019    3.34    .0008    .16590    .63705
_GENNL|2|    .19608    .47857    .41    .6820    -.74190    1.13405
      |This is THETA(03) in class probability model.
Constant|    0.0    .....(Fixed Parameter).....
_GENNL|3|    0.0    .....(Fixed Parameter).....
-----+-----

```

```

--
Note: nnnnn.D-xx or D+xx => multiply by 10 to -xx or +xx.
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
Fixed parameter ... is constrained to equal the value or
had a nonpositive st.error because of an earlier problem.
-----+-----

```

```

|->
|-> Wald;
    Pts=1000;
    Labels =
    b1,    b2,    b3,    b4,    b5,    b6,    a1,
    c1,    c2,    c3,    c4,    c5,    c6,    a2,
    d1,    d2,    d3,    d4,    d5,    d6,    a3,
    e1,e2,e3,e4,e5,e6;
    Start =    b;
    Var =    varb;
    Fn1 =    b1/b6;
    Fn2 =    b2/b6;
    Fn3 =    b3/b6;
    Fn4 =    b4/b6;
    Fn5 =    b5/b6;
    Fn6 =    c1/c6;
    Fn7 =    c2/c6;
    Fn8 =    c3/c6;
    Fn9 =    c4/c6;
    Fn10 =    c5/c6;
    Fn11 =    d1/d6;
    Fn12 =    d2/d6;
    Fn13 =    d3/d6;
    Fn14 =    d4/d6;
    Fn15 =    d5/d6$;

```

```

-----+-----
--
WALD procedure. Estimates and standard errors
for nonlinear functions and joint test of
nonlinear restrictions.

```

```

Wald Statistic          =    235.71885
Prob. from Chi-squared[15] =    .00000
Functions are computed at means of variables
-----+-----

```

```

--
      |          Standard      Prob.      95% Confidence
WaldFcns| Coefficient      Error      z      |z|>Z*      Interval
-----+-----
--
Fncn(1)|    -11.1671***    1.15880    -9.64    .0000    -13.4383    -8.8959

```

Fncn(2)		-13.6262***	1.45826	-9.34	.0000	-16.4844	-10.7681
Fncn(3)		-14.8707***	1.63883	-9.07	.0000	-18.0827	-11.6586
Fncn(4)		-10.7882***	1.07232	-10.06	.0000	-12.8899	-8.6865
Fncn(5)		-11.7840***	1.23207	-9.56	.0000	-14.1988	-9.3692
Fncn(6)		271474	.5798D+09	.00	.9996	-1136086808	1136629757
Fncn(7)		-6202.93	.1323D+08	.00	.9996	*****	
25920119.30							
Fncn(8)		-16950.2	.3618D+08	.00	.9996	-70933460.0	70899559.6
Fncn(9)		-77874.7	.1663D+09	.00	.9996	*****	
325848130.7							
Fncn(10)		11972.5	.2559D+08	.00	.9996	-50137052.3	50160997.3
Fncn(11)		-25.4095***	4.86068	-5.23	.0000	-34.9363	-15.8828
Fncn(12)		-3.01522	2.02160	-1.49	.1358	-6.97749	.94705
Fncn(13)		5.31689	3.79240	1.40	.1609	-2.11608	12.74986
Fncn(14)		14.9812**	6.12254	2.45	.0144	2.9812	26.9811
Fncn(15)		8.33625*	4.50047	1.85	.0640	-.48450	17.15700

-----+-----  
--  
Note: nnnnn.D-xx or D+xx => multiply by 10 to -xx or +xx.  
Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.  
-----+-----  
--

```
|-> NLOGIT;
  Lhs = choice, cset, alti;
  Choices = a, b, c, d;
Model:
  U(a)= csta*ATTB_A + cstb*ATTB_B +
         cstc*ATTB_C + cstd*ATTB_D +
         cste*ATTB_E + cstf*cost/
  U(b)= csta*ATTB_A + cstb*ATTB_B +
         cstc*ATTB_C + cstd*ATTB_D +
         cste*ATTB_E + cstf*cost/
  U(c)= csta*ATTB_A + cstb*ATTB_B +
         cstc*ATTB_C + cstd*ATTB_D +
         cste*ATTB_E + cstf*cost/
  U(d)= ascd;
LCM= GENMS;
parameters;
pts=3;
Pds = 8$;
```

Normal exit: 5 iterations. Status=0, F= 6169.598

-----+-----  
--  
Discrete choice (multinomial logit) model  
Dependent variable Choice  
Log likelihood function -6169.59788  
Estimation based on N = 5168, K = 7  
Inf.Cr.AIC = 12353.2 AIC/N = 2.390  
Model estimated: Jul 02, 2020, 13:31:59  
R2=1-LogL/LogL\* Log-L fncn R-sqrd R2Adj  
Constants only must be computed directly  
Use NLOGIT ;...;RHS=ONE\$  
Response data are given as ind. choices  
Number of obs.= 5168, skipped 0 obs  
-----+-----  
--

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval
--------	-------------	----------------	---	--------------	-------------------------

```

-----+-----
--
CSTA|1|    1.50800***    .08136    18.53    .0000    1.34853    1.66747
CSTB|1|    .41312***    .08194     5.04    .0000    .25252     .57371
CSTC|1|    .27535***    .07945     3.47    .0005    .11963     .43107
CSTD|1|   -.12704    .08524    -1.49    .1361   -.29410     .04002
CSTE|1|    .25096***    .08053     3.12    .0018    .09312     .40881
CSTF|1|   -.03814***    .00830    -4.59    .0000   -.05442    -.02187
ASCD|1|    .36529***    .12958     2.82    .0048    .11132     .61925
-----+-----

```

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

Line search at iteration 48 does not improve fn. Exiting optimization.

```

-----+-----
--
Latent Class Logit Model
Dependent variable          CHOICE
Log likelihood function     -5347.45001
Restricted log likelihood   -7164.36926
Chi squared [ 25 d.f.]     3633.83849
Significance level          .00000
McFadden Pseudo R-squared  .2536049
Estimation based on N =    5168, K = 25
Inf.Cr.AIC = 10744.9 AIC/N = 2.079
Model estimated: Jul 02, 2020, 13:32:05
Constants only must be computed directly
                        Use NLOGIT ;...;RHS=ONE$
At start values -6169.6289 .1333*****
Response data are given as ind. choices
Number of latent classes = 3
Average Class Probabilities
                        .311 .413 .276
LCM model with panel has 646 groups
Fixed number of obsrvs./group= 8
Number of obs.= 5168, skipped 0 obs
-----+-----

```

```

-----+-----
--
      |
      | CHOICE| Coefficient      Standard      Prob.      95% Confidence
      |      |      Error          z          |z|>Z*      Interval
      |-----+-----
--
      |
      | |Utility parameters in latent class -->> 1
CSTA|1|    .81182***    .15558     5.22    .0000    .50688     1.11675
CSTB|1|    .97417***    .15697     6.21    .0000    .66652     1.28182
CSTC|1|    1.06952***    .16389     6.53    .0000    .74830     1.39074
CSTD|1|    .77831***    .17418     4.47    .0000    .43693     1.11969
CSTE|1|    .85216***    .15513     5.49    .0000    .54812     1.15621
CSTF|1|   -.07140***    .01639    -4.36    .0000   -.10351    -.03928
ASCD|1|   -.98799***    .30933    -3.19    .0014   -1.59427   -.38172
      |
      | |Utility parameters in latent class -->> 2
CSTA|2|    2.56304***    .20975    12.22    .0000    2.15193     2.97416
CSTB|2|   -.05364    .20239     -.27    .7910   -.45031     .34303
CSTC|2|   -.16715    .17824     -.94    .3484   -.51650     .18220
CSTD|2|   -.74513***    .20344    -3.66    .0002   -1.14385    -.34640
CSTE|2|    .10121    .18913     .54    .5926   -.26948     .47191
CSTF|2|    .00034    .01999     .02    .9862   -.03883     .03952
ASCD|2|   -.65145*    .34232    -1.90    .0570   -1.32240     .01949
-----+-----

```



```

      |Utility parameters in latent class --> 3
CSTA|3| 1.85970*** .19649 9.46 .0000 1.47459 2.24481
CSTB|3| .22179 .18819 1.18 .2386 -.14705 .59064
CSTC|3| -.38226* .19735 -1.94 .0527 -.76905 .00453
CSTD|3| -1.09435*** .20609 -5.31 .0000 -1.49828 -.69042
CSTE|3| -.60386*** .19637 -3.08 .0021 -.98874 -.21897
CSTF|3| -.07376*** .01853 -3.98 .0001 -.11008 -.03743
ASCD|3| .88018*** .30714 2.87 .0042 .27819 1.48217
      |This is THETA(01) in class probability model.
Constant| .40208** .18156 2.21 .0268 .04623 .75793
_GENMS|1| -.54656** .25379 -2.15 .0313 -1.04397 -.04914
      |This is THETA(02) in class probability model.
Constant| .39686** .18732 2.12 .0341 .02971 .76400
_GENMS|2| .01210 .23939 .05 .9597 -.45710 .48130
      |This is THETA(03) in class probability model.
Constant| 0.0 .....(Fixed Parameter).....
_GENMS|3| 0.0 .....(Fixed Parameter).....
-----+-----

```

```

--
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
Fixed parameter ... is constrained to equal the value or
had a nonpositive st.error because of an earlier problem.
-----+-----

```

```

|->
|-> Wald;
    Pts=1000;
    Labels =
    b1,   b2,   b3,   b4,   b5,   b6,   a1,
    c1,   c2,   c3,   c4,   c5,   c6,   a2,
    d1,   d2,   d3,   d4,   d5,   d6,   a3,
    e1,e2,e3,e4,e5,e6;
    Start =      b;
    Var    =      varb;
    Fn1    =      b1/b6;
    Fn2    =      b2/b6;
    Fn3    =      b3/b6;
    Fn4    =      b4/b6;
    Fn5    =      b5/b6;
    Fn6    =      c1/c6;
    Fn7    =      c2/c6;
    Fn8    =      c3/c6;
    Fn9    =      c4/c6;
    Fn10   =      c5/c6;
    Fn11   =      d1/d6;
    Fn12   =      d2/d6;
    Fn13   =      d3/d6;
    Fn14   =      d4/d6;
    Fn15   =      d5/d6$;

```

```

-----+-----
--
WALD procedure. Estimates and standard errors
for nonlinear functions and joint test of
nonlinear restrictions.

```

```

Wald Statistic      =      226.77596
Prob. from Chi-squared[15] =      .00000
Functions are computed at means of variables
-----+-----

```

	WaldFncns	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
-----+							
--							
Fncn(1)		-11.3704***	1.20307	-9.45	.0000	-13.7284	-9.0124
Fncn(2)		-13.6444***	1.48358	-9.20	.0000	-16.5521	-10.7366
Fncn(3)		-14.9798***	1.69521	-8.84	.0000	-18.3024	-11.6573
Fncn(4)		-10.9011***	1.12520	-9.69	.0000	-13.1065	-8.6958
Fncn(5)		-11.9355***	1.28295	-9.30	.0000	-14.4500	-9.4209
Fncn(6)		7431.35	431179.1	.02	.9862	-837664.14	852526.83
Fncn(7)		-155.514	8490.673	-.02	.9854	-16796.927	16485.899
Fncn(8)		-484.648	27635.34	-.02	.9860	-54648.911	53679.614
Fncn(9)		-2160.44	124681.0	-.02	.9862	-246530.73	242209.86
Fncn(10)		293.459	17500.01	.02	.9866	-34005.935	34592.853
Fncn(11)		-25.2146***	4.83373	-5.22	.0000	-34.6885	-15.7406
Fncn(12)		-3.00712	2.01858	-1.49	.1363	-6.96346	.94922
Fncn(13)		5.18288	3.76414	1.38	.1685	-2.19469	12.56045
Fncn(14)		14.8376**	6.06503	2.45	.0144	2.9504	26.7248
Fncn(15)		8.18731*	4.44963	1.84	.0658	-.53379	16.90842
-----+							

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

```

--
|-> NLOGIT;
Lhs = choice, cset, alti;
Choices = a, b, c, d;
Model:
U(a)= csta*ATTB_A + cstb*ATTB_B +
      cstc*ATTB_C + cstd*ATTB_D +
      cste*ATTB_E + cstf*cost/
U(b)= csta*ATTB_A + cstb*ATTB_B +
      cstc*ATTB_C + cstd*ATTB_D +
      cste*ATTB_E + cstf*cost/
U(c)= csta*ATTB_A + cstb*ATTB_B +
      cstc*ATTB_C + cstd*ATTB_D +
      cste*ATTB_E + cstf*cost/
U(d)= ascd;
LCM= GENMX;
parameters;
pts=3;
Pds = 8$;
Normal exit: 5 iterations. Status=0, F= 6169.598

```

```

-----+
--
Discrete choice (multinomial logit) model
Dependent variable Choice
Log likelihood function -6169.59788
Estimation based on N = 5168, K = 7
Inf.Cr.AIC = 12353.2 AIC/N = 2.390
Model estimated: Jul 02, 2020, 13:32:06
R2=1-LogL/LogL* Log-L fncn R-sqrd R2Adj
Constants only must be computed directly
Use NLOGIT ;...;RHS=ONE$
Response data are given as ind. choices
Number of obs.= 5168, skipped 0 obs

```

	Standard	Prob.	95% Confidence
--	----------	-------	----------------

CHOICE	Coefficient	Error	z	z >Z*	Interval	
CSTA 1	1.50800***	.08136	18.53	.0000	1.34853	1.66747
CSTB 1	.41312***	.08194	5.04	.0000	.25252	.57371
CSTC 1	.27535***	.07945	3.47	.0005	.11963	.43107
CSTD 1	-.12704	.08524	-1.49	.1361	-.29410	.04002
CSTE 1	.25096***	.08053	3.12	.0018	.09312	.40881
CSTF 1	-.03814***	.00830	-4.59	.0000	-.05442	-.02187
ASCD 1	.36529***	.12958	2.82	.0048	.11132	.61925

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

Line search at iteration 49 does not improve fn. Exiting optimization.

```

Latent Class Logit Model
Dependent variable          CHOICE
Log likelihood function     -5351.83623
Restricted log likelihood   -7164.36926
Chi squared [ 25 d.f.]     3625.06605
Significance level         .00000
McFadden Pseudo R-squared  .2529927
Estimation based on N =   5168, K = 25
Inf.Cr.AIC = 10753.7 AIC/N = 2.081
Model estimated: Jul 02, 2020, 13:32:12
Constants only must be computed directly
Use NLOGIT ;...;RHS=ONE$
At start values -6169.6289 .1326*****
Response data are given as ind. choices
Number of latent classes = 3
Average Class Probabilities
    .310 .415 .275
LCM model with panel has 646 groups
Fixed number of obsrvs./group= 8
Number of obs.= 5168, skipped 0 obs

```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Utility parameters in latent class -->> 1						
CSTA 1	.80957***	.15598	5.19	.0000	.50385	1.11528
CSTB 1	.98522***	.15736	6.26	.0000	.67680	1.29365
CSTC 1	1.07488***	.16465	6.53	.0000	.75216	1.39759
CSTD 1	.77952***	.17487	4.46	.0000	.43678	1.12227
CSTE 1	.85199***	.15538	5.48	.0000	.54746	1.15652
CSTF 1	-.07236***	.01644	-4.40	.0000	-.10458	-.04014
ASCD 1	-.96935***	.30782	-3.15	.0016	-1.57266	-.36604
Utility parameters in latent class -->> 2						
CSTA 2	2.56044***	.21056	12.16	.0000	2.14776	2.97313
CSTB 2	-.05657	.20127	-.28	.7787	-.45106	.33792
CSTC 2	-.15698	.17728	-.89	.3759	-.50445	.19048
CSTD 2	-.73285***	.20213	-3.63	.0003	-1.12902	-.33668
CSTE 2	.11475	.18817	.61	.5420	-.25405	.48356
CSTF 2	-.00012	.01989	-.01	.9952	-.03910	.03886

```

ASCD|2|    -.64606*      .34190    -1.89   .0588    -1.31616    .02405
      |Utility parameters in latent class -->> 3
CSTA|3|    1.86402***     .19538     9.54   .0000     1.48108     2.24696
CSTB|3|    .22124       .18714     1.18   .2371     -.14555     .58803
CSTC|3|   -.39133**      .19686    -1.99   .0468     -.77718     -.00549
CSTD|3|   -1.09952***    .20614    -5.33   .0000    -1.50355    -.69549
CSTE|3|   -.61286***     .19692    -3.11   .0019     -.99881     -.22690
CSTF|3|   -.07337***    .01834    -4.00   .0001     -1.10932    -.03742
ASCD|3|    .88105***     .30723     2.87   .0041     .27888     1.48321
      |This is THETA(01) in class probability model.
Constant| .11924       .11952     1.00   .3184     -.11501     .35350
_GENMX|1| .08690       .87108     .10   .9205    -1.62038     1.79419
      |This is THETA(02) in class probability model.
Constant| .41401***     .11870     3.49   .0005     .18137     .64665
_GENMX|2| -.15204       .85236    -.18   .8584    -1.82265     1.51856
      |This is THETA(03) in class probability model.
Constant| 0.0       .....(Fixed Parameter).....
_GENMX|3| 0.0       .....(Fixed Parameter).....

```

```

-----
--
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
Fixed parameter ... is constrained to equal the value or
had a nonpositive st.error because of an earlier problem.
-----
--

```

```

|->
|-> Wald;
    Pts=1000;
    Labels =
    b1,    b2,    b3,    b4,    b5,    b6,    a1,
    c1,    c2,    c3,    c4,    c5,    c6,    a2,
    d1,    d2,    d3,    d4,    d5,    d6,    a3,
    e1,e2,e3,e4,e5,e6;
    Start =      b;
    Var    =      varb;
    Fn1    =      b1/b6;
    Fn2    =      b2/b6;
    Fn3    =      b3/b6;
    Fn4    =      b4/b6;
    Fn5    =      b5/b6;
    Fn6    =      c1/c6;
    Fn7    =      c2/c6;
    Fn8    =      c3/c6;
    Fn9    =      c4/c6;
    Fn10   =      c5/c6;
    Fn11   =      d1/d6;
    Fn12   =      d2/d6;
    Fn13   =      d3/d6;
    Fn14   =      d4/d6;
    Fn15   =      d5/d6$;

```

```

-----
--
WALD procedure. Estimates and standard errors
for nonlinear functions and joint test of
nonlinear restrictions.

```

```

Wald Statistic      =      235.45200
Prob. from Chi-squared[15] =      .00000
Functions are computed at means of variables

```

```

-----+-----
--

```

	WaldFcns	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
-----+-----							
--							
Fncn(1)		-11.1885***	1.16440	-9.61	.0000	-13.4707	-8.9063
Fncn(2)		-13.6161***	1.45771	-9.34	.0000	-16.4732	-10.7591
Fncn(3)		-14.8551***	1.63246	-9.10	.0000	-18.0547	-11.6556
Fncn(4)		-10.7732***	1.07650	-10.01	.0000	-12.8832	-8.6633
Fncn(5)		-11.7748***	1.22550	-9.61	.0000	-14.1767	-9.3729
Fncn(6)		-21342.1	.3537D+07	-.01	.9952	-6953640.6	6910956.3
Fncn(7)		471.559	79688.89	.01	.9953	-155715.788	156658.906
Fncn(8)		1308.51	218243.7	.01	.9952	-426441.27	429058.29
Fncn(9)		6108.53	.1014D+07	.01	.9952	-1981818.60	1994035.66
Fncn(10)		-956.507	157176.7	-.01	.9951	-309017.082	307104.067
Fncn(11)		-25.4054***	4.85659	-5.23	.0000	-34.9241	-15.8866
Fncn(12)		-3.01536	2.02248	-1.49	.1360	-6.97934	.94862
Fncn(13)		5.33361	3.79447	1.41	.1598	-2.10342	12.77063
Fncn(14)		14.9857**	6.12885	2.45	.0145	2.9734	26.9981
Fncn(15)		8.35286*	4.50475	1.85	.0637	-.47629	17.18200

```

-----+-----
--

```

Note: nnnnn.D-xx or D+xx => multiply by 10 to -xx or +xx.  
Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

```

-----+-----
--
|-> NLOGIT;
  lhs      =          choice,   cset,      alti;
  Choices  =          a,        b,          c,          d;
Model:
U(a)=  csta*ATTB_A          +          cstb*ATTB_B          +
       cstc*ATTB_C          +          cstd*ATTB_D          +
       cste*ATTB_E          +          cstf*cost/
U(b)=  csta*ATTB_A          +          cstb*ATTB_B          +
       cstc*ATTB_C          +          cstd*ATTB_D          +
       cste*ATTB_E          +          cstf*cost/
U(c)=  csta*ATTB_A          +          cstb*ATTB_B          +
       cstc*ATTB_C          +          cstd*ATTB_D          +
       cste*ATTB_E          +          cstf*cost/
U(d)=  ascd;
LCM= GENMR;
parameters;
pts=3;
Pds      =          8$;
Normal exit:  5 iterations. Status=0, F=          6169.598

```

```

-----+-----
--
Discrete choice (multinomial logit) model
Dependent variable      Choice
Log likelihood function  -6169.59788
Estimation based on N =  5168, K =  7
Inf.Cr.AIC = 12353.2 AIC/N =  2.390
Model estimated: Jul 02, 2020, 13:32:13
R2=1-LogL/LogL* Log-L fncn R-sqrd R2Adj
Constants only must be computed directly
          Use NLOGIT ;...;RHS=ONE$
Response data are given as ind. choices
Number of obs.=  5168, skipped  0 obs

```

```

-----+-----
--
      |
CHOICE| Coefficient      Standard      Prob.      95% Confidence
      |      Error        z        |z|>Z*      Interval
-----+-----
--
CSTA|1|  1.50800***    .08136    18.53    .0000    1.34853    1.66747
CSTB|1|  .41312***    .08194     5.04    .0000    .25252    .57371
CSTC|1|  .27535***    .07945     3.47    .0005    .11963    .43107
CSTD|1|  -.12704        .08524    -1.49    .1361    -.29410    .04002
CSTE|1|  .25096***    .08053     3.12    .0018    .09312    .40881
CSTF|1|  -.03814***    .00830    -4.59    .0000    -.05442    -.02187
ASCD|1|  .36529***    .12958     2.82    .0048    .11132    .61925
-----+-----

```

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

Normal exit: 58 iterations. Status=0, F= 5344.191

```

-----+-----
--
Latent Class Logit Model
Dependent variable      CHOICE
Log likelihood function  -5344.19083
Restricted log likelihood -7164.36926
Chi squared [ 25 d.f.]  3640.35685
Significance level      .00000
McFadden Pseudo R-squared .2540598
Estimation based on N = 5168, K = 25
Inf.Cr.AIC = 10738.4 AIC/N = 2.078
Model estimated: Jul 02, 2020, 13:32:19
Constants only must be computed directly
Use NLOGIT ;...;RHS=ONE$
At start values -6169.6289 .1338*****
Response data are given as ind. choices
Number of latent classes = 3
Average Class Probabilities
      .308 .413 .278
LCM model with panel has 646 groups
Fixed number of obsrvs./group= 8
Number of obs.= 5168, skipped 0 obs
-----+-----

```

```

-----+-----
--
      |
CHOICE| Coefficient      Standard      Prob.      95% Confidence
      |      Error        z        |z|>Z*      Interval
-----+-----
--
      |Utility parameters in latent class -->> 1
CSTA|1|  .80623***    .15767     5.11    .0000    .49721    1.11525
CSTB|1|  .98062***    .15996     6.13    .0000    .66710    1.29414
CSTC|1|  1.07389***    .16430     6.54    .0000    .75186    1.39592
CSTD|1|  .78454***    .17456     4.49    .0000    .44240    1.12667
CSTE|1|  .85473***    .15618     5.47    .0000    .54862    1.16085
CSTF|1|  -.07120***    .01658    -4.29    .0000    -.10369    -.03870
ASCD|1|  -.98770***    .31097    -3.18    .0015    -1.59719    -.37820
      |Utility parameters in latent class -->> 2
CSTA|2|  2.54602***    .21022    12.11    .0000    2.13401    2.95804
CSTB|2|  -.06746        .20295     -.33    .7396    -.46524    .33032
CSTC|2|  -.16972        .17901     -.95    .3431    -.52057    .18113
-----+-----

```

```

CSTD|2|    -.74175***    .20409    -3.63    .0003    -1.14175    -.34175
CSTE|2|     .10214     .18950     .54    .5899     -.26928     .47355
CSTF|2|     .00060     .02000     .03    .9763     -.03860     .03979
ASCD|2|    -.69402**     .34549     -2.01    .0446     -1.37117     -.01687
    |Utility parameters in latent class -->> 3
CSTA|3|    1.86030***     .19402     9.59    .0000     1.48003     2.24057
CSTB|3|     .23261     .18674     1.25    .2129     -.13339     .59862
CSTC|3|    -.36590*     .19605     -1.87    .0620     -.75015     .01835
CSTD|3|    -1.09073***     .20477     -5.33    .0000     -1.49208     -.68938
CSTE|3|    -.59147***     .19546     -3.03    .0025     -.97456     -.20839
CSTF|3|    -.07369***     .01826     -4.04    .0001     -.10948     -.03790
ASCD|3|     .88651***     .30495     2.91    .0036     .28882     1.48420
    |This is THETA(01) in class probability model.
Constant|   -.17732     .14075     -1.26    .2077     -.45319     .09855
_GENMR|1|   .94368***     .26312     3.59    .0003     .42799     1.45938
    |This is THETA(02) in class probability model.
Constant|   .28610**     .12992     2.20    .0277     .03146     .54075
_GENMR|2|   .44286*     .25984     1.70    .0883     -.06642     .95215
    |This is THETA(03) in class probability model.
Constant|    0.0     .....(Fixed Parameter).....
_GENMR|3|    0.0     .....(Fixed Parameter).....
-----+-----
--

```

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.  
Fixed parameter ... is constrained to equal the value or  
had a nonpositive st.error because of an earlier problem.

```

--
|->
|-> Wald;
    Pts=1000;
    Labels =
    b1,    b2,    b3,    b4,    b5,    b6,    a1,
    c1,    c2,    c3,    c4,    c5,    c6,    a2,
    d1,    d2,    d3,    d4,    d5,    d6,    a3,
    e1,e2,e3,e4,e5,e6;
    Start =      b;
    Var    =      varb;
    Fn1    =      b1/b6;
    Fn2    =      b2/b6;
    Fn3    =      b3/b6;
    Fn4    =      b4/b6;
    Fn5    =      b5/b6;
    Fn6    =      c1/c6;
    Fn7    =      c2/c6;
    Fn8    =      c3/c6;
    Fn9    =      c4/c6;
    Fn10   =      c5/c6;
    Fn11   =      d1/d6;
    Fn12   =      d2/d6;
    Fn13   =      d3/d6;
    Fn14   =      d4/d6;
    Fn15   =      d5/d6$;
-----
--

```

WALD procedure. Estimates and standard errors  
for nonlinear functions and joint test of  
nonlinear restrictions.  
Wald Statistic = 222.04381

Prob. from Chi-squared[15] = .00000  
 Functions are computed at means of variables

```
-----+-----
```

	WaldFcns	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
--							
Fncn(1)		-11.3241***	1.20687	-9.38	.0000	-13.6895	-8.9587
Fncn(2)		-13.7735***	1.51483	-9.09	.0000	-16.7425	-10.8045
Fncn(3)		-15.0837***	1.75169	-8.61	.0000	-18.5169	-11.6504
Fncn(4)		-11.0195***	1.13551	-9.70	.0000	-13.2450	-8.7939
Fncn(5)		-12.0054***	1.30237	-9.22	.0000	-14.5580	-9.4528
Fncn(6)		4277.75	144017.1	.03	.9763	-277990.59	286546.10
Fncn(7)		-113.340	3505.801	-.03	.9742	-6984.583	6757.904
Fncn(8)		-285.159	9318.216	-.03	.9756	-18548.528	17978.209
Fncn(9)		-1246.27	41566.22	-.03	.9761	-82714.56	80222.02
Fncn(10)		171.604	6052.482	.03	.9774	-11691.043	12034.251
Fncn(11)		-25.2448***	4.80632	-5.25	.0000	-34.6650	-15.8246
Fncn(12)		-3.15662	1.98852	-1.59	.1124	-7.05404	.74080
Fncn(13)		4.96538	3.68562	1.35	.1779	-2.25830	12.18906
Fncn(14)		14.8015**	6.01770	2.46	.0139	3.0071	26.5960
Fncn(15)		8.02645*	4.38912	1.83	.0674	-.57607	16.62896

```
-----+-----
```

--  
 Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

```
-----+-----
```

```
--
```

```
|-> NLOGIT;
```

```
  Lhs      =          choice,      cset,      alti;
```

```
  Choices      =          a,          b,          c,          d;
```

```
  Model:
```

```
  U(a)=  csta*ATTB_A          +          cspb*ATTB_B          +
```

```
         cstc*ATTB_C          +          cstd*ATTB_D          +
```

```
         cste*ATTB_E          +          cstf*cost/
```

```
  U(b)=  csta*ATTB_A          +          cspb*ATTB_B          +
```

```
         cstc*ATTB_C          +          cstd*ATTB_D          +
```

```
         cste*ATTB_E          +          cstf*cost/
```

```
  U(c)=  csta*ATTB_A          +          cspb*ATTB_B          +
```

```
         cstc*ATTB_C          +          cstd*ATTB_D          +
```

```
         cste*ATTB_E          +          cstf*cost/
```

```
  U(d)=  ascd;
```

```
  LCM=  GENDOTH;
```

```
  parameters;
```

```
  pts=3;
```

```
  Pds      =          8$;
```

```
Normal exit:  5 iterations. Status=0, F=          6169.598
```

```
-----+-----
```

```
--
```

```
Discrete choice (multinomial logit) model
```

```
Dependent variable          Choice
```

```
Log likelihood function      -6169.59788
```

```
Estimation based on N =    5168, K =    7
```

```
Inf.Cr.AIC = 12353.2 AIC/N =    2.390
```

```
Model estimated: Jul 02, 2020, 13:32:20
```

```
R2=1-LogL/LogL* Log-L fncn R-sqrd R2Adj
```

```
Constants only must be computed directly
```

```
          Use NLOGIT ;...;RHS=ONE$
```

```
Response data are given as ind. choices
```



Number of obs.= 5168, skipped 0 obs

```

-----+-----
--
      |
CHOICE| Coefficient      Standard      Prob.      95% Confidence
      |      Error        z        |z|>Z*      Interval
-----+-----
--
CSTA|1|  1.50800***    .08136    18.53    .0000    1.34853    1.66747
CSTB|1|  .41312***    .08194     5.04    .0000    .25252    .57371
CSTC|1|  .27535***    .07945     3.47    .0005    .11963    .43107
CSTD|1|  -.12704      .08524    -1.49    .1361    -.29410    .04002
CSTE|1|  .25096***    .08053     3.12    .0018    .09312    .40881
CSTF|1|  -.03814***    .00830    -4.59    .0000    -.05442    -.02187
ASCD|1|  .36529***    .12958     2.82    .0048    .11132    .61925
-----+-----

```

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

Normal exit: 29 iterations. Status=0, F= 5626.490

Error: 1027: Models - estimated variance matrix of estimates is singular  
Error: 1027: Models - estimated variance matrix of estimates is singular

```

|->
|-> Wald;
    Pts=1000;
    Labels =
    b1,    b2,    b3,    b4,    b5,    b6,    a1,
    c1,    c2,    c3,    c4,    c5,    c6,    a2,
    d1,    d2,    d3,    d4,    d5,    d6,    a3,
    e1,e2,e3,e4,e5,e6;
    Start =      b;
    Var    =      varb;
    Fn1    =      b1/b6;
    Fn2    =      b2/b6;
    Fn3    =      b3/b6;
    Fn4    =      b4/b6;
    Fn5    =      b5/b6;
    Fn6    =      c1/c6;
    Fn7    =      c2/c6;
    Fn8    =      c3/c6;
    Fn9    =      c4/c6;
    Fn10   =      c5/c6;
    Fn11   =      d1/d6;
    Fn12   =      d2/d6;
    Fn13   =      d3/d6;
    Fn14   =      d4/d6;
    Fn15   =      d5/d6$;

```

WALD procedure. Estimates and standard errors for nonlinear functions and joint test of nonlinear restrictions.

```

Wald Statistic          =      222.04381
Prob. from Chi-squared[15] =      .00000
Functions are computed at means of variables
-----+-----

```

```

--
      |
WaldFcns| Coefficient      Standard      Prob.      95% Confidence
      |      Error        z        |z|>Z*      Interval
-----+-----

```

```

-----+-----
--
Fncn(1) | -11.3241***    1.20687    -9.38    .0000    -13.6895    -8.9587
Fncn(2) | -13.7735***    1.51483    -9.09    .0000    -16.7425   -10.8045
Fncn(3) | -15.0837***    1.75169    -8.61    .0000    -18.5169   -11.6504
Fncn(4) | -11.0195***    1.13551    -9.70    .0000    -13.2450    -8.7939
Fncn(5) | -12.0054***    1.30237    -9.22    .0000    -14.5580    -9.4528
Fncn(6) |  4277.75       144017.1     .03    .9763   -277990.59  286546.10
Fncn(7) | -113.340       3505.801     -.03    .9742   -6984.583   6757.904
Fncn(8) | -285.159       9318.216     -.03    .9756  -18548.528  17978.209
Fncn(9) | -1246.27       41566.22     -.03    .9761   -82714.56   80222.02
Fncn(10) |  171.604       6052.482     .03    .9774  -11691.043  12034.251
Fncn(11) | -25.2448***    4.80632     -5.25    .0000   -34.6650   -15.8246
Fncn(12) | -3.15662       1.98852     -1.59    .1124   -7.05404    .74080
Fncn(13) |  4.96538       3.68562     1.35    .1779   -2.25830    12.18906
Fncn(14) |  14.8015**     6.01770     2.46    .0139    3.0071     26.5960
Fncn(15) |  8.02645*      4.38912     1.83    .0674   - .57607    16.62896
-----+-----

```

```

--
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
-----+-----
--

```

```

|-> NLOGIT;
  Lhs = choice, cset, alti;
  Choices = a, b, c, d;
Model:
  U(a) = csta*ATTB_A + cstb*ATTB_B +
         cstc*ATTB_C + cstd*ATTB_D +
         cste*ATTB_E + cstf*cost/
  U(b) = csta*ATTB_A + cstb*ATTB_B +
         cstc*ATTB_C + cstd*ATTB_D +
         cste*ATTB_E + cstf*cost/
  U(c) = csta*ATTB_A + cstb*ATTB_B +
         cstc*ATTB_C + cstd*ATTB_D +
         cste*ATTB_E + cstf*cost/
  U(d) = ascd;
LCM= EDUBLANK;
parameters;
pts=3;
Pds = 8$;
Normal exit: 5 iterations. Status=0, F= 6169.598
-----+-----

```

```

--
Discrete choice (multinomial logit) model
Dependent variable Choice
Log likelihood function -6169.59788
Estimation based on N = 5168, K = 7
Inf.Cr.AIC = 12353.2 AIC/N = 2.390
Model estimated: Jul 02, 2020, 13:32:24
R2=1-LogL/LogL* Log-L fncn R-sqrd R2Adj
Constants only must be computed directly
Use NLOGIT ;...;RHS=ONE$
Response data are given as ind. choices
Number of obs.= 5168, skipped 0 obs
-----+-----

```

```

--
      |
CHOICE| Coefficient      Standard      Prob.      95% Confidence
      |              Error        z          |z|>Z*      Interval
-----+-----

```

```

-----+-----
--
CSTA|1|    1.50800***    .08136    18.53    .0000    1.34853    1.66747
CSTB|1|    .41312***    .08194     5.04    .0000    .25252     .57371
CSTC|1|    .27535***    .07945     3.47    .0005    .11963     .43107
CSTD|1|   -.12704    .08524    -1.49    .1361   -.29410     .04002
CSTE|1|    .25096***    .08053     3.12    .0018    .09312     .40881
CSTF|1|   -.03814***    .00830    -4.59    .0000   -.05442    -.02187
ASCD|1|    .36529***    .12958     2.82    .0048    .11132     .61925
-----+-----

```

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

Line search at iteration 47 does not improve fn. Exiting optimization.

```

-----+-----
--
Latent Class Logit Model
Dependent variable          CHOICE
Log likelihood function     -5351.73063
Restricted log likelihood   -7164.36926
Chi squared [ 25 d.f.]     3625.27725
Significance level         .00000
McFadden Pseudo R-squared  .2530074
Estimation based on N =   5168, K = 25
Inf.Cr.AIC = 10753.5 AIC/N = 2.081
Model estimated: Jul 02, 2020, 13:32:31
Constants only must be computed directly
      Use NLOGIT ;...;RHS=ONE$
At start values -6169.6289 .1326*****
Response data are given as ind. choices
Number of latent classes = 3
Average Class Probabilities
      .310 .275 .415
LCM model with panel has 646 groups
Fixed number of obsrvs./group= 8
Number of obs.= 5168, skipped 0 obs
-----+-----

```

```

-----+-----
--
      |
      | CHOICE| Coefficient      Standard      Prob.      95% Confidence
      |      |      |      Error      z      |z|>Z*      Interval
      |      |      |      |      |      |      |
-----+-----
      |
      | |Utility parameters in latent class -->> 1
CSTA|1|    .81038***    .15667     5.17    .0000    .50330    1.11745
CSTB|1|    .98878***    .15802     6.26    .0000    .67907    1.29849
CSTC|1|    1.07903***    .16529     6.53    .0000    .75506    1.40299
CSTD|1|    .78211***    .17545     4.46    .0000    .43824    1.12599
CSTE|1|    .85460***    .15578     5.49    .0000    .54927    1.15992
CSTF|1|   -.07259***    .01664    -4.36    .0000   -.10519   -.03998
ASCD|1|   -.96405***    .30864    -3.12    .0018   -1.56898   -.35913
      |
      | |Utility parameters in latent class -->> 2
CSTA|2|    1.86552***    .19686     9.48    .0000    1.47968    2.25136
CSTB|2|    .22168    .18852     1.18    .2396   -.14782     .59118
CSTC|2|   -.39016**    .19755    -1.97    .0483   -.77735   -.00296
CSTD|2|   -1.09884***    .20722    -5.30    .0000   -1.50499   -.69270
CSTE|2|   -.61082***    .19708    -3.10    .0019   -.99708   -.22455
CSTF|2|   -.07338***    .01853    -3.96    .0001   -.10970   -.03706
ASCD|2|    .88386***    .31066     2.85    .0044    .27498    1.49273
-----+-----

```

```

      |Utility parameters in latent class --> 3
CSTA|3| 2.55434*** .21138 12.08 .0000 2.14004 2.96865
CSTB|3| -.05810 .20176 -.29 .7734 -.45353 .33734
CSTC|3| -.15925 .17712 -.90 .3686 -.50641 .18790
CSTD|3| -.73179*** .20255 -3.61 .0003 -1.12878 -.33481
CSTE|3| .11291 .18877 .60 .5498 -.25707 .48289
CSTF|3| -.40685D-04 .01989 .00 .9984 -.39017D-01 .38936D-01
ASCD|3| -.65605* .34483 -1.90 .0571 -1.33191 .01981
      |This is THETA(01) in class probability model.
Constant| -.29577** .12004 -2.46 .0137 -.53105 -.06048
_EDUBL|1| -.00021 .00110 -.19 .8506 -.00237 .00195
      |This is THETA(02) in class probability model.
Constant| -.40904*** .11689 -3.50 .0005 -.63814 -.17994
_EDUBL|2| .00042 .00129 .33 .7436 -.00211 .00296
      |This is THETA(03) in class probability model.
Constant| 0.0 .....(Fixed Parameter).....
_EDUBL|3| 0.0 .....(Fixed Parameter).....
-----+-----
--

```

```

Note: nnnnn.D-xx or D+xx => multiply by 10 to -xx or +xx.
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
Fixed parameter ... is constrained to equal the value or
had a nonpositive st.error because of an earlier problem.
-----+-----
--

```

```

|->
|-> Wald;
    Pts=1000;
    Labels =
    b1,   b2,   b3,   b4,   b5,   b6,   a1,
    c1,   c2,   c3,   c4,   c5,   c6,   a2,
    d1,   d2,   d3,   d4,   d5,   d6,   a3,
    e1,e2,e3,e4,e5,e6;
    Start =      b;
    Var    =      varb;
    Fn1    =      b1/b6;
    Fn2    =      b2/b6;
    Fn3    =      b3/b6;
    Fn4    =      b4/b6;
    Fn5    =      b5/b6;
    Fn6    =      c1/c6;
    Fn7    =      c2/c6;
    Fn8    =      c3/c6;
    Fn9    =      c4/c6;
    Fn10   =      c5/c6;
    Fn11   =      d1/d6;
    Fn12   =      d2/d6;
    Fn13   =      d3/d6;
    Fn14   =      d4/d6;
    Fn15   =      d5/d6$;

```

```

-----+-----
--
WALD procedure. Estimates and standard errors
for nonlinear functions and joint test of
nonlinear restrictions.
Wald Statistic      =      229.31584
Prob. from Chi-squared[15] =      .00000
Functions are computed at means of variables

```

```

-----+-----
--
|
WaldFcns| Coefficient      Standard      Prob.      95% Confidence
          |               Error        z        |z|>Z*      Interval
-----+-----
--
Fncn(1)| -11.1638***      1.17356      -9.51      .0000      -13.4640      -8.8637
Fncn(2)| -13.6216***      1.48279      -9.19      .0000      -16.5278      -10.7153
Fncn(3)| -14.8648***      1.65040      -9.01      .0000      -18.0995      -11.6300
Fncn(4)| -10.7744***      1.08238      -9.95      .0000      -12.8959      -8.6530
Fncn(5)| -11.7730***      1.26173      -9.33      .0000      -14.2459      -9.3000
Fncn(6)| -25.4223***      4.89377      -5.19      .0000      -35.0139      -15.8307
Fncn(7)| -3.02100          2.03091      -1.49      .1369      -7.00151      .95951
Fncn(8)| 5.31684          3.81607      1.39      .1635      -2.16252      12.79620
Fncn(9)| 14.9745**        6.18077      2.42      .0154      2.8604      27.0886
Fncn(10)| 8.32388*         4.52672      1.84      .0659      -.54833      17.19610
Fncn(11)| -62783.2         .3070D+08      .00      .9984      -60237275.5      60111709.2
Fncn(12)| 1427.92          702818.3      .00      .9984      -1376070.62      1378926.46
Fncn(13)| 3914.28          .1918D+07      .00      .9984      -3755766.84      3763595.40
Fncn(14)| 17986.8          .8801D+07      .00      .9984      -17232580.8      17268554.3
Fncn(15)| -2775.20         .1353D+07      .00      .9984      -2654876.25      2649325.86
-----+-----
--

```

Note: nnnnn.D-xx or D+xx => multiply by 10 to -xx or +xx.  
Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

```

--
|-> NLOGIT;
  lhs = choice, cset, alti;
  Choices = a, b, c, d;
Model:
U(a)= csta*ATTB_A + cstab*ATTB_B +
      cstc*ATTB_C + cstd*ATTB_D +
      cste*ATTB_E + cstf*cost/
U(b)= csta*ATTB_A + cstab*ATTB_B +
      cstc*ATTB_C + cstd*ATTB_D +
      cste*ATTB_E + cstf*cost/
U(c)= csta*ATTB_A + cstab*ATTB_B +
      cstc*ATTB_C + cstd*ATTB_D +
      cste*ATTB_E + cstf*cost/
U(d)= ascd;
LCM= EDUUND;
parameters;
pts=3;
Pds = 8$;
Normal exit: 5 iterations. Status=0, F= 6169.598

```

```

-----+-----
--
Discrete choice (multinomial logit) model
Dependent variable      Choice
Log likelihood function  -6169.59788
Estimation based on N = 5168, K = 7
Inf.Cr.AIC = 12353.2 AIC/N = 2.390
Model estimated: Jul 02, 2020, 13:32:32
R2=1-LogL/LogL* Log-L fncn R-sqrd R2Adj
Constants only must be computed directly
      Use NLOGIT ;...;RHS=ONE$
Response data are given as ind. choices
Number of obs.= 5168, skipped 0 obs

```

```

-----+-----
--
      |
CHOICE| Coefficient      Standard      Prob.      95% Confidence
      |      Error        z        |z|>Z*      Interval
-----+-----
--
CSTA|1|  1.50800***    .08136    18.53    .0000    1.34853    1.66747
CSTB|1|  .41312***    .08194     5.04    .0000    .25252     .57371
CSTC|1|  .27535***    .07945     3.47    .0005    .11963     .43107
CSTD|1|  -.12704      .08524    -1.49    .1361    -.29410    .04002
CSTE|1|  .25096***    .08053     3.12    .0018    .09312     .40881
CSTF|1|  -.03814***    .00830    -4.59    .0000    -.05442    -.02187
ASCD|1|  .36529***    .12958     2.82    .0048    .11132     .61925
-----+-----

```

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

Maximum of 100 iterations. Exit iterations with status=1.

```

-----+-----
--
Latent Class Logit Model
Dependent variable      CHOICE
Log likelihood function -5408.75209
Restricted log likelihood -7164.36926
Chi squared [ 25 d.f.]  3511.23433
Significance level      .00000
McFadden Pseudo R-squared .2450484
Estimation based on N = 5168, K = 25
Inf.Cr.AIC = 10867.5 AIC/N = 2.103
Model estimated: Jul 02, 2020, 13:33:26
Constants only must be computed directly
Use NLOGIT ;...;RHS=ONE$
At start values -6169.6289 .1233*****
Response data are given as ind. choices
Number of latent classes = 3
Average Class Probabilities
      .292 .261 .447
LCM model with panel has 646 groups
Fixed number of obsrvs./group= 8
Number of obs.= 5168, skipped 0 obs
-----+-----

```

```

-----+-----
--
      |
CHOICE| Coefficient      Standard      Prob.      95% Confidence
      |      Error        z        |z|>Z*      Interval
-----+-----
--
      |Utility parameters in latent class -->> 1
CSTA|1|  1.29360***    .17887     7.23    .0000    .94301     1.64418
CSTB|1|  1.63311***    .18955     8.62    .0000    1.26161     2.00461
CSTC|1|  1.47870***    .18395     8.04    .0000    1.11817     1.83922
CSTD|1|  1.09540***    .19251     5.69    .0000    .71809     1.47272
CSTE|1|  1.10174***    .17018     6.47    .0000    .76820     1.43529
CSTF|1|  -.12212***    .01878    -6.50    .0000    -.15893    -.08531
ASCD|1|  -.46618      .34102    -1.37    .1716    -1.13457    .20220
      |Utility parameters in latent class -->> 2
CSTA|2|  1.59113***    .22194     7.17    .0000    1.15614     2.02613
CSTB|2|  -.25045      .21395    -1.17    .2418    -.66979     .16889
CSTC|2|  -.82709***    .22401    -3.69    .0002    -1.26615    -.38803
-----+-----

```

```

CSTD|2|   -1.81942***   .24741   -7.35   .0000   -2.30432   -1.33451
CSTE|2|   -1.13236***   .22608   -5.01   .0000   -1.57547   -.68925
CSTF|2|    -.04933**    .01973   -2.50   .0124   -.08800   -.01067
ASCD|2|    .05449         .36680    .15   .8819   -.66443    .77341
      |Utility parameters in latent class -->> 3
CSTA|3|    2.11763***     .19393   10.92   .0000   1.73754   2.49773
CSTB|3|   -.06153         .18016    -.34   .7327   -.41463    .29158
CSTC|3|   -.10845         .16722    -.65   .5166   -.43620    .21929
CSTD|3|   -.56183***     .18095   -3.10   .0019   -.91649   -.20717
CSTE|3|    .15776         .16769    .94   .3468   -.17091    .48643
CSTF|3|    .00766         .01799    .43   .6702   -.02760    .04292
ASCD|3|   -.23129         .29179    -.79   .4280   -.80319    .34062
      |This is THETA(01) in class probability model.
Constant|   -.13802         .19274    -.72   .4739   -.51578    .23974
_EDUUN|1|  -1.68997***       .22498   -7.51   .0000   -2.13091   -1.24902
      |This is THETA(02) in class probability model.
Constant|   -.51354***     .16357   -3.14   .0017   -.83413   -.19295
_EDUUN|2|   -.09919         .22494    -.44   .6592   -.54005    .34168
      |This is THETA(03) in class probability model.
Constant|    0.0         .....(Fixed Parameter).....
_EDUUN|3|    0.0         .....(Fixed Parameter).....
-----+-----

```

```

--
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
Fixed parameter ... is constrained to equal the value or
had a nonpositive st.error because of an earlier problem.
-----

```

```

--
|->
|-> Wald;
    Pts=1000;
    Labels =
    b1,    b2,    b3,    b4,    b5,    b6,    a1,
    c1,    c2,    c3,    c4,    c5,    c6,    a2,
    d1,    d2,    d3,    d4,    d5,    d6,    a3,
    e1,e2,e3,e4,e5,e6;
    Start =          b;
    Var    =          varb;
    Fn1    =          b1/b6;
    Fn2    =          b2/b6;
    Fn3    =          b3/b6;
    Fn4    =          b4/b6;
    Fn5    =          b5/b6;
    Fn6    =          c1/c6;
    Fn7    =          c2/c6;
    Fn8    =          c3/c6;
    Fn9    =          c4/c6;
    Fn10   =          c5/c6;
    Fn11   =          d1/d6;
    Fn12   =          d2/d6;
    Fn13   =          d3/d6;
    Fn14   =          d4/d6;
    Fn15   =          d5/d6$;

```

```

-----
--
WALD procedure. Estimates and standard errors
for nonlinear functions and joint test of
nonlinear restrictions.
Wald Statistic          =          500.85688

```

Prob. from Chi-squared[15] = .00000  
 Functions are computed at means of variables

```
-----+-----
```

WaldFcns	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Fncn(1)	-10.5926***	.75524	-14.03	.0000	-12.0728	-9.1123
Fncn(2)	-13.3727***	.97194	-13.76	.0000	-15.2776	-11.4677
Fncn(3)	-12.1083***	.80261	-15.09	.0000	-13.6813	-10.5352
Fncn(4)	-8.96966***	.71655	-12.52	.0000	-10.37408	-7.56524
Fncn(5)	-9.02159***	.69043	-13.07	.0000	-10.37480	-7.66837
Fncn(6)	-32.2518***	10.24586	-3.15	.0016	-52.3333	-12.1703
Fncn(7)	5.07652	6.00937	.84	.3982	-6.70163	16.85468
Fncn(8)	16.7649	10.47536	1.60	.1095	-3.7665	37.2962
Fncn(9)	36.8790**	18.56473	1.99	.0470	.4928	73.2652
Fncn(10)	22.9526*	12.90383	1.78	.0753	-2.3384	48.2436
Fncn(11)	276.393	666.1968	.41	.6782	-1029.329	1582.115
Fncn(12)	-8.03029	11.39322	-.70	.4809	-30.36059	14.30001
Fncn(13)	-14.1550	17.14867	-.83	.4091	-47.7658	19.4558
Fncn(14)	-73.3297	151.2411	-.48	.6278	-369.7568	223.0974
Fncn(15)	20.5908	68.25748	.30	.7629	-113.1914	154.3730

```
-----+-----
```

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

```
-----
```

```
|-> NLOGIT;
  Lhs      =          choice,      cset,      alti;
  Choices  =          a,           b,         c,         d;
  Model:
  U(a)=  csta*ATTB_A          +          cspb*ATTB_B          +
         cstc*ATTB_C          +          cstd*ATTB_D          +
         cste*ATTB_E          +          cstf*cost/
  U(b)=  csta*ATTB_A          +          cspb*ATTB_B          +
         cstc*ATTB_C          +          cstd*ATTB_D          +
         cste*ATTB_E          +          cstf*cost/
  U(c)=  csta*ATTB_A          +          cspb*ATTB_B          +
         cstc*ATTB_C          +          cstd*ATTB_D          +
         cste*ATTB_E          +          cstf*cost/
  U(d)=  ascd;
  LCM= EDUSCH;
  parameters;
  pts=3;
  Pds    =          8$;
Normal exit:  5 iterations. Status=0, F=          6169.598
```

```
-----
```

```
--
Discrete choice (multinomial logit) model
Dependent variable      Choice
Log likelihood function  -6169.59788
Estimation based on N =  5168, K =  7
Inf.Cr.AIC = 12353.2 AIC/N =  2.390
Model estimated: Jul 02, 2020, 13:33:26
R2=1-LogL/LogL* Log-L fncn R-sqrd R2Adj
Constants only must be computed directly
          Use NLOGIT ;...;RHS=ONE$
Response data are given as ind. choices
```



Number of obs.= 5168, skipped 0 obs

```

-----+-----
--
      |
CHOICE| Coefficient      Standard      Prob.      95% Confidence
      |      Error        z        |z|>Z*      Interval
-----+-----
--
CSTA|1|  1.50800***    .08136    18.53    .0000    1.34853    1.66747
CSTB|1|  .41312***    .08194     5.04    .0000    .25252    .57371
CSTC|1|  .27535***    .07945     3.47    .0005    .11963    .43107
CSTD|1|  -.12704      .08524    -1.49    .1361    -.29410    .04002
CSTE|1|  .25096***    .08053     3.12    .0018    .09312    .40881
CSTF|1|  -.03814***    .00830    -4.59    .0000    -.05442    -.02187
ASCD|1|  .36529***    .12958     2.82    .0048    .11132    .61925
-----+-----

```

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

Normal exit: 49 iterations. Status=0, F= 5351.715

```

-----+-----
--
Latent Class Logit Model
Dependent variable      CHOICE
Log likelihood function -5351.71462
Restricted log likelihood -7164.36926
Chi squared [ 25 d.f.]  3625.30928
Significance level      .00000
McFadden Pseudo R-squared .2530097
Estimation based on N = 5168, K = 25
Inf.Cr.AIC = 10753.4 AIC/N = 2.081
Model estimated: Jul 02, 2020, 13:33:33
Constants only must be computed directly
      Use NLOGIT ;...;RHS=ONE$
At start values -6169.6289 .1326*****
Response data are given as ind. choices
Number of latent classes = 3
Average Class Probabilities
      .310 .275 .415
LCM model with panel has 646 groups
Fixed number of obsrvs./group= 8
Number of obs.= 5168, skipped 0 obs
-----+-----

```

```

-----+-----
--
      |
CHOICE| Coefficient      Standard      Prob.      95% Confidence
      |      Error        z        |z|>Z*      Interval
-----+-----
--
      |Utility parameters in latent class -->> 1
CSTA|1|  .81040***    .15666     5.17    .0000    .50335    1.11745
CSTB|1|  .98929***    .15799     6.26    .0000    .67965    1.29894
CSTC|1|  1.08001***    .16519     6.54    .0000    .75624    1.40378
CSTD|1|  .78277***    .17540     4.46    .0000    .43898    1.12655
CSTE|1|  .85571***    .15573     5.49    .0000    .55048    1.16094
CSTF|1|  -.07263***    .01662    -4.37    .0000    -.10520    -.04006
ASCD|1|  -.96292***    .30852    -3.12    .0018    -1.56760    -.35823
      |Utility parameters in latent class -->> 2
CSTA|2|  1.86444***    .19673     9.48    .0000    1.47885    2.25002
CSTB|2|  .22168      .18845     1.18    .2395    -.14768    .59104
-----+-----

```

```

CSTC|2|    -.39082**      .19749    -1.98   .0478    -.77790    -.00374
CSTD|2|   -1.09942***     .20716    -5.31   .0000    -1.50545   -.69339
CSTE|2|   -.61233***     .19709    -3.11   .0019    -.99861    -.22605
CSTF|2|   -.07336***     .01852    -3.96   .0001    -.10965    -.03706
ASCD|2|    .88161***      .31055     2.84   .0045     .27294     1.49028
      |Utility parameters in latent class -->> 3
CSTA|3|    2.55441***     .21098    12.11   .0000     2.14091     2.96792
CSTB|3|   -.05751      .20193     -.28   .7758    -.45329     .33827
CSTC|3|   -.15895      .17702     -.90   .3692    -.50591     .18801
CSTD|3|   -.73082***     .20252    -3.61   .0003    -1.12775    -.33390
CSTE|3|    .11330      .18837     .60   .5475    -.25590     .48251
CSTF|3|  -.92252D-04     .01988     .00   .9963   -.39053D-01 .38869D-01
ASCD|3|   -.65476*      .34421    -1.90   .0571    -1.32940     .01989
      |This is THETA(01) in class probability model.
Constant|   -.29831**      .11987    -2.49   .0128    -.53325    -.06338
_EDUSC|1|   -.00046      .00115     -.40   .6888    -.00271     .00179
      |This is THETA(02) in class probability model.
Constant|   -.41134***      .11681    -3.52   .0004    -.64029    -.18239
_EDUSC|2|    .00017      .00133     .13   .8993    -.00244     .00278
      |This is THETA(03) in class probability model.
Constant|         0.0      .....(Fixed Parameter).....
_EDUSC|3|         0.0      .....(Fixed Parameter).....
-----+-----
--

```

Note: nnnnn.D-xx or D+xx => multiply by 10 to -xx or +xx.  
Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.  
Fixed parameter ... is constrained to equal the value or  
had a nonpositive st.error because of an earlier problem.

```

|->
|-> Wald;
    Pts=1000;
    Labels =
    b1,    b2,        b3,        b4,        b5,        b6,        a1,
    c1,    c2,        c3,        c4,        c5,        c6,        a2,
    d1,    d2,        d3,        d4,        d5,        d6,        a3,
    e1,e2,e3,e4,e5,e6;
    Start  =          b;
    Var    =          varb;
    Fn1    =          b1/b6;
    Fn2    =          b2/b6;
    Fn3    =          b3/b6;
    Fn4    =          b4/b6;
    Fn5    =          b5/b6;
    Fn6    =          c1/c6;
    Fn7    =          c2/c6;
    Fn8    =          c3/c6;
    Fn9    =          c4/c6;
    Fn10   =          c5/c6;
    Fn11   =          d1/d6;
    Fn12   =          d2/d6;
    Fn13   =          d3/d6;
    Fn14   =          d4/d6;
    Fn15   =          d5/d6$;

```

-----+-----  
--  
WALD procedure. Estimates and standard errors  
for nonlinear functions and joint test of

nonlinear restrictions.  
Wald Statistic = 230.25081  
Prob. from Chi-squared[15] = .00000  
Functions are computed at means of variables

```
-----+-----
```

WaldFcns	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Fncn(1)	-11.1578***	1.17033	-9.53	.0000	-13.4516	-8.8640
Fncn(2)	-13.6208***	1.48021	-9.20	.0000	-16.5220	-10.7197
Fncn(3)	-14.8699***	1.64865	-9.02	.0000	-18.1012	-11.6386
Fncn(4)	-10.7773***	1.08131	-9.97	.0000	-12.8966	-8.6580
Fncn(5)	-11.7816***	1.25884	-9.36	.0000	-14.2489	-9.3144
Fncn(6)	-25.4164***	4.89207	-5.20	.0000	-35.0046	-15.8281
Fncn(7)	-3.02200	2.03097	-1.49	.1368	-7.00263	.95863
Fncn(8)	5.32772	3.81836	1.40	.1629	-2.15612	12.81156
Fncn(9)	14.9875**	6.18329	2.42	.0154	2.8685	27.1065
Fncn(10)	8.34743*	4.53272	1.84	.0655	-.53654	17.23140
Fncn(11)	-27689.6	.5965D+07	.00	.9963	-11719759.7	11664380.4
Fncn(12)	623.400	136312.8	.00	.9964	-266544.741	267791.542
Fncn(13)	1723.00	373010.1	.00	.9963	-729363.32	732809.31
Fncn(14)	7922.04	.1709D+07	.00	.9963	-3342116.92	3357961.00
Fncn(15)	-1228.19	262854.2	.00	.9963	-516412.95	513956.56

```
-----+-----
```

Note: nnnnn.D-xx or D+xx => multiply by 10 to -xx or +xx.  
Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

```
-----+-----
```

```

--
|-> NLOGIT;
  Lhs = choice, cset, alti;
  Choices = a, b, c, d;
  Model:
  U(a)= csta*ATTB_A + cstb*ATTB_B +
         cstc*ATTB_C + cstd*ATTB_D +
         cste*ATTB_E + cstf*cost/
  U(b)= csta*ATTB_A + cstb*ATTB_B +
         cstc*ATTB_C + cstd*ATTB_D +
         cste*ATTB_E + cstf*cost/
  U(c)= csta*ATTB_A + cstb*ATTB_B +
         cstc*ATTB_C + cstd*ATTB_D +
         cste*ATTB_E + cstf*cost/
  U(d)= ascd;
  LCM= EDUPNTS;
  parameters;
  pts=3;
  Pds = 8$;
Normal exit: 5 iterations. Status=0, F= 6169.598

```

```
-----+-----
```

```

--
Discrete choice (multinomial logit) model
Dependent variable Choice
Log likelihood function -6169.59788
Estimation based on N = 5168, K = 7
Inf.Cr.AIC = 12353.2 AIC/N = 2.390
Model estimated: Jul 02, 2020, 13:33:34
R2=1-LogL/LogL* Log-L fncn R-sqrd R2Adj

```

Constants only must be computed directly  
 Use NLOGIT ;...;RHS=ONE\$  
 Response data are given as ind. choices  
 Number of obs.= 5168, skipped 0 obs

```
-----+-----
```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
CSTA 1	1.50800***	.08136	18.53	.0000	1.34853	1.66747
CSTB 1	.41312***	.08194	5.04	.0000	.25252	.57371
CSTC 1	.27535***	.07945	3.47	.0005	.11963	.43107
CSTD 1	-.12704	.08524	-1.49	.1361	-.29410	.04002
CSTE 1	.25096***	.08053	3.12	.0018	.09312	.40881
CSTF 1	-.03814***	.00830	-4.59	.0000	-.05442	-.02187
ASCD 1	.36529***	.12958	2.82	.0048	.11132	.61925

```
-----+-----
```

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

Line search at iteration 52 does not improve fn. Exiting optimization.

```
-----+-----
```

Latent Class Logit Model  
 Dependent variable CHOICE  
 Log likelihood function -5351.47920  
 Restricted log likelihood -7164.36926  
 Chi squared [ 25 d.f.] 3625.78011  
 Significance level .00000  
 McFadden Pseudo R-squared .2530425  
 Estimation based on N = 5168, K = 25  
 Inf.Cr.AIC = 10753.0 AIC/N = 2.081  
 Model estimated: Jul 02, 2020, 13:33:40  
 Constants only must be computed directly  
 Use NLOGIT ;...;RHS=ONE\$  
 At start values -6169.6289 .1326\*\*\*\*\*  
 Response data are given as ind. choices  
 Number of latent classes = 3  
 Average Class Probabilities  
 .309 .275 .416  
 LCM model with panel has 646 groups  
 Fixed number of obsrvs./group= 8  
 Number of obs.= 5168, skipped 0 obs

```
-----+-----
```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Utility parameters in latent class -->> 1						
CSTA 1	.80980***	.15673	5.17	.0000	.50262	1.11697
CSTB 1	.98977***	.15804	6.26	.0000	.68003	1.29952
CSTC 1	1.08083***	.16518	6.54	.0000	.75707	1.40458
CSTD 1	.78467***	.17535	4.47	.0000	.44099	1.12836
CSTE 1	.85600***	.15585	5.49	.0000	.55055	1.16146
CSTF 1	-.07268***	.01661	-4.38	.0000	-.10523	-.04013
ASCD 1	-.96195***	.30859	-3.12	.0018	-1.56678	-.35712

```

      |Utility parameters in latent class --> 2
CSTA|2| 1.86398*** .19675 9.47 .0000 1.47836 2.24959
CSTB|2| .22120 .18845 1.17 .2405 -.14816 .59056
CSTC|2| -.39133** .19752 -1.98 .0476 -.77847 -.00419
CSTD|2| -1.09967*** .20724 -5.31 .0000 -1.50586 -.69348
CSTE|2| -.61296*** .19711 -3.11 .0019 -.99928 -.22663
CSTF|2| -.07337*** .01852 -3.96 .0001 -.10966 -.03708
ASCD|2| .88092*** .31052 2.84 .0046 .27230 1.48954
      |Utility parameters in latent class --> 3
CSTA|3| 2.55212*** .20996 12.15 .0000 2.14060 2.96364
CSTB|3| -.05621 .20192 -.28 .7807 -.45197 .33956
CSTC|3| -.15762 .17699 -.89 .3732 -.50451 .18928
CSTD|3| -.73070*** .20187 -3.62 .0003 -1.12636 -.33504
CSTE|3| .11425 .18863 .61 .5447 -.25546 .48397
CSTF|3| -.00019 .01986 -.01 .9925 -.03912 .03875
ASCD|3| -.65465* .34322 -1.91 .0565 -1.32735 .01806
      |This is THETA(01) in class probability model.
Constant| -.30385** .11939 -2.54 .0109 -.53785 -.06984
_EDUPN|1| -.00109 .00136 -.80 .4242 -.00376 .00158
      |This is THETA(02) in class probability model.
Constant| -.41664*** .11655 -3.57 .0004 -.64507 -.18821
_EDUPN|2| -.00052 .00155 -.34 .7351 -.00355 .00251
      |This is THETA(03) in class probability model.
Constant| 0.0 .....(Fixed Parameter).....
_EDUPN|3| 0.0 .....(Fixed Parameter).....
-----+-----

```

```

--
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
Fixed parameter ... is constrained to equal the value or
had a nonpositive st.error because of an earlier problem.
-----

```

```

|->
|-> Wald;
    Pts=1000;
    Labels =
    b1,    b2,    b3,    b4,    b5,    b6,    a1,
    c1,    c2,    c3,    c4,    c5,    c6,    a2,
    d1,    d2,    d3,    d4,    d5,    d6,    a3,
    e1,e2,e3,e4,e5,e6;
    Start =          b;
    Var    =          varb;
    Fn1    =          b1/b6;
    Fn2    =          b2/b6;
    Fn3    =          b3/b6;
    Fn4    =          b4/b6;
    Fn5    =          b5/b6;
    Fn6    =          c1/c6;
    Fn7    =          c2/c6;
    Fn8    =          c3/c6;
    Fn9    =          c4/c6;
    Fn10   =          c5/c6;
    Fn11   =          d1/d6;
    Fn12   =          d2/d6;
    Fn13   =          d3/d6;
    Fn14   =          d4/d6;
    Fn15   =          d5/d6$;

```

WALD procedure. Estimates and standard errors for nonlinear functions and joint test of nonlinear restrictions.

Wald Statistic = 231.74623  
 Prob. from Chi-squared[15] = .00000  
 Functions are computed at means of variables

```
-----+-----
```

WaldFcns	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Fncn(1)	-11.1423***	1.16519	-9.56	.0000	-13.4261	-8.8586
Fncn(2)	-13.6187***	1.47715	-9.22	.0000	-16.5139	-10.7236
Fncn(3)	-14.8716***	1.64653	-9.03	.0000	-18.0988	-11.6445
Fncn(4)	-10.7967***	1.07858	-10.01	.0000	-12.9106	-8.6827
Fncn(5)	-11.7781***	1.25341	-9.40	.0000	-14.2348	-9.3215
Fncn(6)	-25.4049***	4.88806	-5.20	.0000	-34.9853	-15.8245
Fncn(7)	-3.01478	2.03199	-1.48	.1379	-6.99741	.96785
Fncn(8)	5.33356	3.81900	1.40	.1625	-2.15155	12.81867
Fncn(9)	14.9879**	6.18281	2.42	.0153	2.8698	27.1060
Fncn(10)	8.35425*	4.53336	1.84	.0654	-.53096	17.23947
Fncn(11)	-13735.5	.1468D+07	-.01	.9925	-2890049.3	2862578.2
Fncn(12)	302.507	33318.52	.01	.9928	-65000.598	65605.613
Fncn(13)	848.284	91530.86	.01	.9926	-178548.895	180245.464
Fncn(14)	3932.62	421415.0	.01	.9926	-822025.59	829890.84
Fncn(15)	-614.908	64830.84	-.01	.9924	-127681.020	126451.205

```
-----+-----
```

Note: nnnnn.D-xx or D+xx => multiply by 10 to -xx or +xx.  
 Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

```
-----+-----
```

```

--
|-> NLOGIT;
Lhs = choice, cset, alti;
Choices = a, b, c, d;
Model:
U(a)= csta*ATTB_A + cstab*ATTB_B +
      cstc*ATTB_C + cstd*ATTB_D +
      cste*ATTB_E + cstf*cost/
U(b)= csta*ATTB_A + cstab*ATTB_B +
      cstc*ATTB_C + cstd*ATTB_D +
      cste*ATTB_E + cstf*cost/
U(c)= csta*ATTB_A + cstab*ATTB_B +
      cstc*ATTB_C + cstd*ATTB_D +
      cste*ATTB_E + cstf*cost/
U(d)= ascd;
LCM= EDUPOST;
parameters;
pts=3;
Pds = 8$;
Normal exit: 5 iterations. Status=0, F= 6169.598

```

```
-----+-----
```

```

--
Discrete choice (multinomial logit) model
Dependent variable Choice
Log likelihood function -6169.59788
Estimation based on N = 5168, K = 7
Inf.Cr.AIC = 12353.2 AIC/N = 2.390

```

Model estimated: Jul 02, 2020, 13:33:41  
R2=1-LogL/LogL\* Log-L fncn R-sqrd R2Adj  
Constants only must be computed directly  
Use NLOGIT ;...;RHS=ONE\$  
Response data are given as ind. choices  
Number of obs.= 5168, skipped 0 obs

```
-----+-----
```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
CSTA 1	1.50800***	.08136	18.53	.0000	1.34853	1.66747
CSTB 1	.41312***	.08194	5.04	.0000	.25252	.57371
CSTC 1	.27535***	.07945	3.47	.0005	.11963	.43107
CSTD 1	-.12704	.08524	-1.49	.1361	-.29410	.04002
CSTE 1	.25096***	.08053	3.12	.0018	.09312	.40881
CSTF 1	-.03814***	.00830	-4.59	.0000	-.05442	-.02187
ASCD 1	.36529***	.12958	2.82	.0048	.11132	.61925

```
-----+-----
```

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

Line search at iteration 58 does not improve fn. Exiting optimization.

```
-----+-----
```

Latent Class Logit Model  
Dependent variable CHOICE  
Log likelihood function -5350.56598  
Restricted log likelihood -7164.36926  
Chi squared [ 25 d.f.] 3627.60656  
Significance level .00000  
McFadden Pseudo R-squared .2531700  
Estimation based on N = 5168, K = 25  
Inf.Cr.AIC = 10751.1 AIC/N = 2.080  
Model estimated: Jul 02, 2020, 13:33:50  
Constants only must be computed directly  
Use NLOGIT ;...;RHS=ONE\$  
At start values -6169.6289 .1328\*\*\*\*\*  
Response data are given as ind. choices  
Number of latent classes = 3  
Average Class Probabilities  
.309 .275 .416  
LCM model with panel has 646 groups  
Fixed number of obsrvs./group= 8  
Number of obs.= 5168, skipped 0 obs

```
-----+-----
```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Utility parameters in latent class -->> 1						
CSTA 1	.80983***	.15658	5.17	.0000	.50294	1.11672
CSTB 1	.98993***	.15776	6.27	.0000	.68073	1.29913
CSTC 1	1.08098***	.16478	6.56	.0000	.75802	1.40394
CSTD 1	.78480***	.17495	4.49	.0000	.44190	1.12769
CSTE 1	.85615***	.15573	5.50	.0000	.55093	1.16138

```
-----+-----
```

```

CSTF|1|    -.07268***    .01655    -4.39    .0000    -.10511    -.04025
ASCD|1|    -.96215***    .30836    -3.12    .0018    -1.56653    -.35778
      |Utility parameters in latent class -->> 2
CSTA|2|    1.86487***    .19516    9.56    .0000    1.48237    2.24738
CSTB|2|    .22221    .18706    1.19    .2349    -.14441    .58884
CSTC|2|    -.39035**    .19650    -1.99    .0470    -.77547    -.00522
CSTD|2|    -1.09892***    .20602    -5.33    .0000    -1.50271    -.69513
CSTE|2|    -.61177***    .19628    -3.12    .0018    -.99646    -.22707
CSTF|2|    -.07336***    .01833    -4.00    .0001    -.10927    -.03744
ASCD|2|    .88240***    .30703    2.87    .0041    .28064    1.48416
      |Utility parameters in latent class -->> 3
CSTA|3|    2.55136***    .20994    12.15    .0000    2.13988    2.96284
CSTB|3|    -.05768    .20186    -.29    .7751    -.45332    .33796
CSTC|3|    -.15839    .17702    -.89    .3709    -.50535    .18857
CSTD|3|    -.73142***    .20192    -3.62    .0003    -1.12718    -.33565
CSTE|3|    .11357    .18869    .60    .5473    -.25626    .48339
CSTF|3|    -.73835D-04    .01986    .00    .9970    -.39004D-01    .38856D-01
ASCD|3|    -.65892*    .34289    -1.92    .0546    -1.33097    .01312
      |This is THETA(01) in class probability model.
Constant|    -.30292**    .11938    -2.54    .0112    -.53690    -.06894
_EDUPO|1|    -.00106    .00133    -.79    .4269    -.00367    .00155
      |This is THETA(02) in class probability model.
Constant|    -.41144***    .11700    -3.52    .0004    -.64076    -.18213
_EDUPO|2|    .00580    .02297    .25    .8008    -.03923    .05082
      |This is THETA(03) in class probability model.
Constant|    0.0    .....(Fixed Parameter).....
_EDUPO|3|    0.0    .....(Fixed Parameter).....
-----+-----
--

```

Note: nnnnn.D-xx or D+xx => multiply by 10 to -xx or +xx.  
Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.  
Fixed parameter ... is constrained to equal the value or  
had a nonpositive st.error because of an earlier problem.

--

```

|->
|-> Wald;
    Pts=1000;
    Labels =
    b1,    b2,    b3,    b4,    b5,    b6,    a1,
    c1,    c2,    c3,    c4,    c5,    c6,    a2,
    d1,    d2,    d3,    d4,    d5,    d6,    a3,
    e1,e2,e3,e4,e5,e6;
    Start =    b;
    Var =    varb;
    Fn1 =    b1/b6;
    Fn2 =    b2/b6;
    Fn3 =    b3/b6;
    Fn4 =    b4/b6;
    Fn5 =    b5/b6;
    Fn6 =    c1/c6;
    Fn7 =    c2/c6;
    Fn8 =    c3/c6;
    Fn9 =    c4/c6;
    Fn10 =    c5/c6;
    Fn11 =    d1/d6;
    Fn12 =    d2/d6;
    Fn13 =    d3/d6;
    Fn14 =    d4/d6;
    Fn15 =    d5/d6$;

```



```

-----
--
WALD procedure. Estimates and standard errors
for nonlinear functions and joint test of
nonlinear restrictions.
Wald Statistic           =      232.41903
Prob. from Chi-squared[15] =      .00000
Functions are computed at means of variables
-----

```

```

--

```

	WaldFcns	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Fncn(1)		-11.1419***	1.15830	-9.62	.0000	-13.4121	-8.8717
Fncn(2)		-13.6197***	1.47086	-9.26	.0000	-16.5026	-10.7369
Fncn(3)		-14.8724***	1.64112	-9.06	.0000	-18.0890	-11.6559
Fncn(4)		-10.7975***	1.07743	-10.02	.0000	-12.9092	-8.6858
Fncn(5)		-11.7792***	1.24475	-9.46	.0000	-14.2189	-9.3395
Fncn(6)		-25.4225***	4.85715	-5.23	.0000	-34.9424	-15.9027
Fncn(7)		-3.02929	2.01953	-1.50	.1336	-6.98749	.92891
Fncn(8)		5.32132	3.78880	1.40	.1602	-2.10458	12.74723
Fncn(9)		14.9808**	6.12450	2.45	.0144	2.9770	26.9846
Fncn(10)		8.33978*	4.49794	1.85	.0637	-.47602	17.15559
Fncn(11)		-34554.8	.9295D+07	.00	.9970	-18252566.4	18183456.9
Fncn(12)		781.178	212639.5	.00	.9971	-415984.651	417547.007
Fncn(13)		2145.17	579301.7	.00	.9970	-1133265.32	1137555.67
Fncn(14)		9906.09	.2668D+07	.00	.9970	-5218932.27	5238744.45
Fncn(15)		-1538.14	411566.2	.00	.9970	-808193.11	805116.83

```

-----
--

```

```

Note: nnnnn.D-xx or D+xx => multiply by 10 to -xx or +xx.
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
-----

```

```

--
|-> NLOGIT;
  lhs      =          choice,      cset,      alti;
  Choices  =          a,          b,          c,          d;
  Model:
  U(a)=  csta*ATTB_A      +          cstab*ATTB_B      +
         cstc*ATTB_C      +          cstd*ATTB_D      +
         cste*ATTB_E      +          cstf*cost/
  U(b)=  csta*ATTB_A      +          cstab*ATTB_B      +
         cstc*ATTB_C      +          cstd*ATTB_D      +
         cste*ATTB_E      +          cstf*cost/
  U(c)=  csta*ATTB_A      +          cstab*ATTB_B      +
         cstc*ATTB_C      +          cstd*ATTB_D      +
         cste*ATTB_E      +          cstf*cost/
  U(d)=  ascd;
  LCM=  EDUHIGH;
  parameters;
  pts=3;
  Pds   =          8$;
Normal exit:  5 iterations. Status=0, F=          6169.598
-----

```

```

--
Discrete choice (multinomial logit) model
Dependent variable          Choice

```

```

Log likelihood function      -6169.59788
Estimation based on N =    5168, K =    7
Inf.Cr.AIC = 12353.2 AIC/N =    2.390
Model estimated: Jul 02, 2020, 13:33:51
R2=1-LogL/LogL* Log-L fncn R-sqrd R2Adj
Constants only must be computed directly
      Use NLOGIT ;...;RHS=ONE$
Response data are given as ind. choices
Number of obs.= 5168, skipped    0 obs

```

```

-----+-----
--

```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
CSTA 1	1.50800***	.08136	18.53	.0000	1.34853	1.66747
CSTB 1	.41312***	.08194	5.04	.0000	.25252	.57371
CSTC 1	.27535***	.07945	3.47	.0005	.11963	.43107
CSTD 1	-.12704	.08524	-1.49	.1361	-.29410	.04002
CSTE 1	.25096***	.08053	3.12	.0018	.09312	.40881
CSTF 1	-.03814***	.00830	-4.59	.0000	-.05442	-.02187
ASCD 1	.36529***	.12958	2.82	.0048	.11132	.61925

```

-----+-----
--

```

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

Line search at iteration 22 does not improve fn. Exiting optimization.

```

-----+-----
--
Latent Class Logit Model
Dependent variable          CHOICE
Log likelihood function     -5503.80186
Restricted log likelihood   -7164.36926
Chi squared [ 25 d.f.]     3321.13479
Significance level         .00000
McFadden Pseudo R-squared  .2317814
Estimation based on N =    5168, K =    25
Inf.Cr.AIC = 11057.6 AIC/N =    2.140
Model estimated: Jul 02, 2020, 13:33:56
Constants only must be computed directly
      Use NLOGIT ;...;RHS=ONE$
At start values -6169.6289 .1079*****
Response data are given as ind. choices
Number of latent classes =    3
Average Class Probabilities
      .346 .195 .458
LCM model with panel has    646 groups
Fixed number of obsrvs./group=    8
BHHH estimator used for asymp. variance
Number of obs.= 5168, skipped    0 obs

```

```

-----+-----
--

```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
CSTA 1	1.07904***	.13791	7.82	.0000	.80874	1.34934

```

-----+-----
--
|Utility parameters in latent class -->> 1

```

```

CSTB|1|      .87714***      .13547      6.47      .0000      .61163      1.14265
CSTC|1|      .88401***      .13067      6.77      .0000      .62791      1.14011
CSTD|1|      .47403***      .13932      3.40      .0007      .20097      .74709
CSTE|1|      .76466***      .13500      5.66      .0000      .50007      1.02926
CSTF|1|     -.06027***      .01423      -4.24      .0000      -.08817      -.03238
ASCD|1|     -.94409***      .24411      -3.87      .0001      -1.42255      -.46564
      |Utility parameters in latent class --> 2
CSTA|2|      1.77000***      .26121      6.78      .0000      1.25804      2.28196
CSTB|2|     -.05582      .25397      -.22      .8260      -.55359      .44195
CSTC|2|     -.20260      .27348      -.74      .4588      -.73862      .33341
CSTD|2|     -1.41477***      .28195      -5.02      .0000      -1.96738      -.86216
CSTE|2|     -1.13013***      .23761      -4.76      .0000      -1.59584      -.66442
CSTF|2|     -.17255***      .02402      -7.18      .0000      -.21964      -.12547
ASCD|2|     -.19557      .42997      -.45      .6492      -1.03829      .64714
      |Utility parameters in latent class --> 3
CSTA|3|      3.75447***      .24882      15.09      .0000      3.26678      4.24216
CSTB|3|     -.13545      .20763      -.65      .5142      -.54240      .27150
CSTC|3|     -.18845      .18596      -1.01      .3109      -.55293      .17603
CSTD|3|     -.71345***      .20845      -3.42      .0006      -1.12201      -.30489
CSTE|3|      .10338      .20907      .49      .6210      -.30639      .51315
CSTF|3|      .03533*      .02069      1.71      .0877      -.00522      .07589
ASCD|3|      2.06751***      .33518      6.17      .0000      1.41057      2.72445
      |This is THETA(01) in class probability model.
Constant|     -.25575**      .11317      -2.26      .0238      -.47756      -.03394
_EDUHI|1|     -.40221      .36289      -1.11      .2677      -1.11346      .30904
      |This is THETA(02) in class probability model.
Constant|     -.79896***      .13189      -6.06      .0000      -1.05747      -.54046
_EDUHI|2|     -1.16168***      .36288      -3.20      .0014      -1.87291      -.45044
      |This is THETA(03) in class probability model.
Constant|      0.0      ..... (Fixed Parameter) .....
_EDUHI|3|      0.0      ..... (Fixed Parameter) .....
-----+-----
--

```

```

--
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
Fixed parameter ... is constrained to equal the value or
had a nonpositive st.error because of an earlier problem.
-----
--

```

```

|->
|-> Wald;
    Pts=1000;
    Labels =
    b1,    b2,    b3,    b4,    b5,    b6,    a1,
    c1,    c2,    c3,    c4,    c5,    c6,    a2,
    d1,    d2,    d3,    d4,    d5,    d6,    a3,
    e1,e2,e3,e4,e5,e6;
    Start =      b;
    Var    =      varb;
    Fn1    =      b1/b6;
    Fn2    =      b2/b6;
    Fn3    =      b3/b6;
    Fn4    =      b4/b6;
    Fn5    =      b5/b6;
    Fn6    =      c1/c6;
    Fn7    =      c2/c6;
    Fn8    =      c3/c6;
    Fn9    =      c4/c6;
    Fn10   =      c5/c6;
    Fn11   =      d1/d6;
    Fn12   =      d2/d6;

```

```

Fn13 = d3/d6;
Fn14 = d4/d6;
Fn15 = d5/d6$;

```

```

-----
--
WALD procedure. Estimates and standard errors
for nonlinear functions and joint test of
nonlinear restrictions.
Wald Statistic = 568.28844
Prob. from Chi-squared[15] = .00000
Functions are computed at means of variables
-----

```

WaldFcns	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Fncn(1)	-17.9020***	2.30951	-7.75	.0000	-22.4286	-13.3755
Fncn(2)	-14.5524***	1.43518	-10.14	.0000	-17.3653	-11.7395
Fncn(3)	-14.6664***	1.57901	-9.29	.0000	-17.7612	-11.5715
Fncn(4)	-7.86444***	.80175	-9.81	.0000	-9.43584	-6.29304
Fncn(5)	-12.6863***	1.08064	-11.74	.0000	-14.8043	-10.5683
Fncn(6)	-10.2577***	.93235	-11.00	.0000	-12.0851	-8.4303
Fncn(7)	.32349	1.51076	.21	.8305	-2.63756	3.28453
Fncn(8)	1.17415	1.72301	.68	.4956	-2.20288	4.55118
Fncn(9)	8.19900***	2.63318	3.11	.0018	3.03806	13.35994
Fncn(10)	6.54946***	2.16358	3.03	.0025	2.30891	10.79000
Fncn(11)	106.257	66.83176	1.59	.1119	-24.731	237.244
Fncn(12)	-3.83340	3.96446	-.97	.3336	-11.60359	3.93679
Fncn(13)	-5.33345*	2.97378	-1.79	.0729	-11.16195	.49504
Fncn(14)	-20.1916***	6.89906	-2.93	.0034	-33.7135	-6.6697
Fncn(15)	2.92585	7.53314	.39	.6977	-11.83883	17.69053

```

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
-----

```

```

|-> NLOGIT;
Lhs = choice, cset, alti;
Choices = a, b, c, d;
Model:
U(a)= csta*ATTB_A + cstb*ATTB_B +
      cstc*ATTB_C + cstd*ATTB_D +
      cste*ATTB_E + cstf*cost/
U(b)= csta*ATTB_A + cstb*ATTB_B +
      cstc*ATTB_C + cstd*ATTB_D +
      cste*ATTB_E + cstf*cost/
U(c)= csta*ATTB_A + cstb*ATTB_B +
      cstc*ATTB_C + cstd*ATTB_D +
      cste*ATTB_E + cstf*cost/
U(d)= ascd;
LCM= EDUALEV;
parameters;
pts=3;
Pds = 8$;
Normal exit: 5 iterations. Status=0, F= 6169.598
-----

```

Discrete choice (multinomial logit) model  
 Dependent variable Choice  
 Log likelihood function -6169.59788  
 Estimation based on N = 5168, K = 7  
 Inf.Cr.AIC = 12353.2 AIC/N = 2.390  
 Model estimated: Jul 02, 2020, 13:33:56  
 R2=1-LogL/LogL\* Log-L fncn R-sqrd R2Adj  
 Constants only must be computed directly  
 Use NLOGIT ;...;RHS=ONE\$  
 Response data are given as ind. choices  
 Number of obs.= 5168, skipped 0 obs

```
-----+-----
```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
CSTA 1	1.50800***	.08136	18.53	.0000	1.34853	1.66747
CSTB 1	.41312***	.08194	5.04	.0000	.25252	.57371
CSTC 1	.27535***	.07945	3.47	.0005	.11963	.43107
CSTD 1	-.12704	.08524	-1.49	.1361	-.29410	.04002
CSTE 1	.25096***	.08053	3.12	.0018	.09312	.40881
CSTF 1	-.03814***	.00830	-4.59	.0000	-.05442	-.02187
ASCD 1	.36529***	.12958	2.82	.0048	.11132	.61925

```
-----+-----
```

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

Line search at iteration 74 does not improve fn. Exiting optimization.

```
-----+-----
```

Latent Class Logit Model  
 Dependent variable CHOICE  
 Log likelihood function -5350.42190  
 Restricted log likelihood -7164.36926  
 Chi squared [ 25 d.f.] 3627.89471  
 Significance level .00000  
 McFadden Pseudo R-squared .2531901  
 Estimation based on N = 5168, K = 25  
 Inf.Cr.AIC = 10750.8 AIC/N = 2.080  
 Model estimated: Jul 02, 2020, 13:34:14  
 Constants only must be computed directly  
 Use NLOGIT ;...;RHS=ONE\$  
 At start values -6169.6289 .1328\*\*\*\*\*  
 Response data are given as ind. choices  
 Number of latent classes = 3  
 Average Class Probabilities  
 .310 .415 .276  
 LCM model with panel has 646 groups  
 Fixed number of obsrvs./group= 8  
 Number of obs.= 5168, skipped 0 obs

```
-----+-----
```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
--------	-------------	----------------	---	--------------	-------------------------	--

```
-----+-----
```

|Utility parameters in latent class -->> 1

```

CSTA|1|      .81248***      .15604      5.21  .0000      .50665      1.11831
CSTB|1|      .97734***      .15700      6.23  .0000      .66962      1.28505
CSTC|1|      1.07438***      .16393      6.55  .0000      .75307      1.39568
CSTD|1|      .77914***      .17439      4.47  .0000      .43734      1.12093
CSTE|1|      .85600***      .15534      5.51  .0000      .55154      1.16046
CSTF|1|     -.07214***      .01641      -4.40 .0000      -.10430      -.03997
ASCD|1|     -.96225***      .30675      -3.14 .0017      -1.56348      -.36102
|Utility parameters in latent class --> 2
CSTA|2|      2.55354***      .20993      12.16 .0000      2.14208      2.96500
CSTB|2|     -.05889      .20125      -.29  .7698      -.45334      .33556
CSTC|2|     -.16564      .17734      -.93  .3503      -.51323      .18195
CSTD|2|     -.73570***      .20211      -3.64 .0003      -1.13183      -.33956
CSTE|2|      .10651      .18805      .57  .5711      -.26206      .47508
CSTF|2|      .00052      .01988      .03  .9793      -.03844      .03948
ASCD|2|     -.64826*      .34176      -1.90 .0579      -1.31810      .02158
|Utility parameters in latent class --> 3
CSTA|3|      1.86186***      .19539      9.53  .0000      1.47890      2.24482
CSTB|3|      .21326      .18788      1.14 .2563      -.15498      .58149
CSTC|3|     -.39983**      .19695      -2.03 .0423      -.78585      -.01382
CSTD|3|     -1.10267***      .20649      -5.34 .0000      -1.50738      -.69796
CSTE|3|     -.62411***      .19712      -3.17 .0015      -1.01046      -.23776
CSTF|3|     -.07312***      .01840      -3.97 .0001      -.10917      -.03706
ASCD|3|      .86612***      .30735      2.82  .0048      .26372      1.46853
|This is THETA(01) in class probability model.
Constant|      .11758      .11992      .98  .3268      -.11746      .35263
_EDUAL|1|     -1.0230      .39123      -.26  .7937      -.86910      .66451
|This is THETA(02) in class probability model.
Constant|      .41377***      .11877      3.48  .0005      .18098      .64656
_EDUAL|2|     -.09441      .39118      -.24  .8093      -.86111      .67230
|This is THETA(03) in class probability model.
Constant|      0.0      ..... (Fixed Parameter) .....
_EDUAL|3|      0.0      ..... (Fixed Parameter) .....

```

```

-----+
--
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
Fixed parameter ... is constrained to equal the value or
had a nonpositive st.error because of an earlier problem.
-----+
--

```

```

|->
|-> Wald;
    Pts=1000;
    Labels =
    b1,    b2,    b3,    b4,    b5,    b6,    a1,
    c1,    c2,    c3,    c4,    c5,    c6,    a2,
    d1,    d2,    d3,    d4,    d5,    d6,    a3,
    e1,e2,e3,e4,e5,e6;
    Start =      b;
    Var    =      varb;
    Fn1    =      b1/b6;
    Fn2    =      b2/b6;
    Fn3    =      b3/b6;
    Fn4    =      b4/b6;
    Fn5    =      b5/b6;
    Fn6    =      c1/c6;
    Fn7    =      c2/c6;
    Fn8    =      c3/c6;
    Fn9    =      c4/c6;
    Fn10   =      c5/c6;
    Fn11   =      d1/d6;

```

```

Fn12 = d2/d6;
Fn13 = d3/d6;
Fn14 = d4/d6;
Fn15 = d5/d6$;

```

```

-----
--
WALD procedure. Estimates and standard errors
for nonlinear functions and joint test of
nonlinear restrictions.
Wald Statistic = 230.43124
Prob. from Chi-squared[15] = .00000
Functions are computed at means of variables
-----

```

WaldFcns	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Fncn(1)	-11.2632***	1.17200	-9.61	.0000	-13.5603	-8.9661
Fncn(2)	-13.5486***	1.44991	-9.34	.0000	-16.3904	-10.7068
Fncn(3)	-14.8938***	1.64221	-9.07	.0000	-18.1125	-11.6751
Fncn(4)	-10.8010***	1.08229	-9.98	.0000	-12.9222	-8.6797
Fncn(5)	-11.8665***	1.24884	-9.50	.0000	-14.3142	-9.4189
Fncn(6)	4947.90	190897.5	.03	.9793	-369204.26	379100.06
Fncn(7)	-114.109	4049.012	-.03	.9775	-8050.027	7821.808
Fncn(8)	-320.952	12059.40	-.03	.9788	-23956.948	23315.043
Fncn(9)	-1425.53	54550.86	-.03	.9792	-108343.26	105492.19
Fncn(10)	206.378	8276.962	.02	.9801	-16016.169	16428.925
Fncn(11)	-25.4632***	4.92412	-5.17	.0000	-35.1143	-15.8121
Fncn(12)	-2.91657	2.05138	-1.42	.1551	-6.93720	1.10406
Fncn(13)	5.46821	3.83620	1.43	.1540	-2.05059	12.98702
Fncn(14)	15.0803**	6.18869	2.44	.0148	2.9507	27.2099
Fncn(15)	8.53549*	4.57869	1.86	.0623	-.43857	17.50955

```

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
-----

```

```

|-> NLOGIT;
Lhs = choice, cset, alti;
Choices = a, b, c, d;
Model:
U(a) = csta*ATTB_A + cstb*ATTB_B +
       cstc*ATTB_C + cstd*ATTB_D +
       cste*ATTB_E + cstf*cost/
U(b) = csta*ATTB_A + cstb*ATTB_B +
       cstc*ATTB_C + cstd*ATTB_D +
       cste*ATTB_E + cstf*cost/
U(c) = csta*ATTB_A + cstb*ATTB_B +
       cstc*ATTB_C + cstd*ATTB_D +
       cste*ATTB_E + cstf*cost/
U(d) = ascd;
LCM= PROF;
parameters;
pts=3;
Pds = 8$;
Normal exit: 5 iterations. Status=0, F= 6169.598

```

```

-----
--
Discrete choice (multinomial logit) model
Dependent variable          Choice
Log likelihood function     -6169.59788
Estimation based on N =    5168, K =    7
Inf.Cr.AIC = 12353.2 AIC/N =    2.390
Model estimated: Jul 02, 2020, 13:34:15
R2=1-LogL/LogL* Log-L fncn R-sqrd R2Adj
Constants only must be computed directly
      Use NLOGIT ;...;RHS=ONE$
Response data are given as ind. choices
Number of obs.= 5168, skipped    0 obs
-----

```

```

-----
--

```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
CSTA 1	1.50800***	.08136	18.53	.0000	1.34853	1.66747
CSTB 1	.41312***	.08194	5.04	.0000	.25252	.57371
CSTC 1	.27535***	.07945	3.47	.0005	.11963	.43107
CSTD 1	-.12704	.08524	-1.49	.1361	-.29410	.04002
CSTE 1	.25096***	.08053	3.12	.0018	.09312	.40881
CSTF 1	-.03814***	.00830	-4.59	.0000	-.05442	-.02187
ASCD 1	.36529***	.12958	2.82	.0048	.11132	.61925

```

-----

```

```

--
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
-----

```

```

--
Normal exit: 53 iterations. Status=0, F= 5339.920
-----

```

```

--
Latent Class Logit Model
Dependent variable          CHOICE
Log likelihood function     -5339.91990
Restricted log likelihood   -7164.36926
Chi squared [ 25 d.f.]     3648.89871
Significance level         .00000
McFadden Pseudo R-squared .2546560
Estimation based on N =    5168, K =    25
Inf.Cr.AIC = 10729.8 AIC/N =    2.076
Model estimated: Jul 02, 2020, 13:34:20
Constants only must be computed directly
      Use NLOGIT ;...;RHS=ONE$
At start values -6169.6289 .1345*****
Response data are given as ind. choices
Number of latent classes =    3
Average Class Probabilities
      .309 .415 .276
LCM model with panel has    646 groups
Fixed number of obsrvs./group=    8
Number of obs.= 5168, skipped    0 obs
-----

```

```

--

```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
--------	-------------	----------------	---	--------------	-------------------------	--



```

-----+-----
--
      |Utility parameters in latent class -->> 1
CSTA|1|   .79476***   .15616   5.09   .0000   .48869   1.10083
CSTB|1|   .96897***   .15739   6.16   .0000   .66049   1.27744
CSTC|1|   1.05211***   .16342   6.44   .0000   .73182   1.37240
CSTD|1|   .75699***   .17285   4.38   .0000   .41821   1.09578
CSTE|1|   .83676***   .15467   5.41   .0000   .53361   1.13991
CSTF|1|  -.06911***   .01636  -4.22   .0000  -.10118  -.03704
ASCD|1|  -1.01793***   .30983  -3.29   .0010  -1.62518  -.41068
      |Utility parameters in latent class -->> 2
CSTA|2|   2.57369***   .20943  12.29   .0000   2.16321   2.98416
CSTB|2|  -.04258   .20235   -.21   .8333  -.43919   .35402
CSTC|2|  -.15972   .17759   -.90   .3685  -.50779   .18835
CSTD|2|  -.72270***   .20200  -3.58   .0003  -1.11860  -.32679
CSTE|2|   .11197   .18834   .59   .5522  -.25717   .48112
CSTF|2|  -.00126   .01993   -.06   .9495  -.04032   .03780
ASCD|2|  -.62757*   .34087  -1.84   .0656  -1.29566   .04053
      |Utility parameters in latent class -->> 3
CSTA|3|   1.83267***   .19341   9.48   .0000   1.45360   2.21175
CSTB|3|   .21368   .18614   1.15   .2510  -.15114   .57850
CSTC|3|  -.35317*   .19457  -1.82   .0695  -.73452   .02818
CSTD|3|  -1.08393***   .20508  -5.29   .0000  -1.48588  -.68198
CSTE|3|  -.57941***   .19478  -2.97   .0029  -.96116  -.19766
CSTF|3|  -.07665***   .01817  -4.22   .0000  -1.1226  -.04103
ASCD|3|   .85243***   .30577   2.79   .0053   .25313   1.45173
      |This is THETA(01) in class probability model.
Constant|  -.35297**   .15311  -2.31   .0212  -.65306  -.05287
 _PROF|1|   1.24578***   .24724   5.04   .0000   .76120   1.73037
      |This is THETA(02) in class probability model.
Constant|   .27468**   .13343   2.06   .0395   .01315   .53620
 _PROF|2|   .47189**   .23997   1.97   .0492   .00156   .94221
      |This is THETA(03) in class probability model.
Constant|    0.0   .....(Fixed Parameter).....
 _PROF|3|    0.0   .....(Fixed Parameter).....
-----+-----
--
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
Fixed parameter ... is constrained to equal the value or
had a nonpositive st.error because of an earlier problem.
-----+-----
--
|->
|-> Wald;
    Pts=1000;
    Labels =
    b1,   b2,   b3,   b4,   b5,   b6,   a1,
    c1,   c2,   c3,   c4,   c5,   c6,   a2,
    d1,   d2,   d3,   d4,   d5,   d6,   a3,
    e1,e2,e3,e4,e5,e6;
    Start =          b;
    Var    =          varb;
    Fn1    =          b1/b6;
    Fn2    =          b2/b6;
    Fn3    =          b3/b6;
    Fn4    =          b4/b6;
    Fn5    =          b5/b6;
    Fn6    =          c1/c6;
    Fn7    =          c2/c6;
    Fn8    =          c3/c6;

```

```

Fn9    =      c4/c6;
Fn10   =      c5/c6;
Fn11   =      d1/d6;
Fn12   =      d2/d6;
Fn13   =      d3/d6;
Fn14   =      d4/d6;
Fn15   =      d5/d6$;

```

```

-----
--
WALD procedure. Estimates and standard errors
for nonlinear functions and joint test of
nonlinear restrictions.

```

```

Wald Statistic      =      220.36913
Prob. from Chi-squared[15] =      .00000
Functions are computed at means of variables
-----

```

WaldFcns	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Fncn(1)	-11.5001***	1.25244	-9.18	.0000	-13.9548	-9.0453
Fncn(2)	-14.0209***	1.59451	-8.79	.0000	-17.1461	-10.8957
Fncn(3)	-15.2240***	1.77362	-8.58	.0000	-18.7002	-11.7478
Fncn(4)	-10.9537***	1.12943	-9.70	.0000	-13.1673	-8.7400
Fncn(5)	-12.1079***	1.33102	-9.10	.0000	-14.7166	-9.4991
Fncn(6)	-2038.56	32047.71	-.06	.9493	-64850.92	60773.80
Fncn(7)	33.7304	679.9452	.05	.9604	-1298.9377	1366.3984
Fncn(8)	126.511	2122.262	.06	.9525	-4033.047	4286.069
Fncn(9)	572.433	9181.630	.06	.9503	-17423.232	18568.098
Fncn(10)	-88.6912	1268.198	-.07	.9442	-2574.3143	2396.9320
Fncn(11)	-23.9106***	4.23536	-5.65	.0000	-32.2117	-15.6094
Fncn(12)	-2.78788	1.95835	-1.42	.1546	-6.62618	1.05042
Fncn(13)	4.60778	3.44310	1.34	.1808	-2.14058	11.35614
Fncn(14)	14.1419**	5.63461	2.51	.0121	3.0982	25.1855
Fncn(15)	7.55945*	4.10028	1.84	.0652	-.47695	15.59585

```

-----
--
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
-----

```

```

|-> NLOGIT;
Lhs      =      choice,      cset,      alti;
Choices  =      a,          b,          c,          d;
Model:
U(a)=  csta*ATTB_A      +      cstab*ATTB_B      +
      cstc*ATTB_C      +      cstd*ATTB_D      +
      cste*ATTB_E      +      cstf*cost/
U(b)=  csta*ATTB_A      +      cstab*ATTB_B      +
      cstc*ATTB_C      +      cstd*ATTB_D      +
      cste*ATTB_E      +      cstf*cost/
U(c)=  csta*ATTB_A      +      cstab*ATTB_B      +
      cstc*ATTB_C      +      cstd*ATTB_D      +
      cste*ATTB_E      +      cstf*cost/
U(d)=  ascd;
LCM= PROFBLK;
parameters;
pts=3;
Pds      =      8$;

```

Normal exit: 5 iterations. Status=0, F= 6169.598

-----  
--  
Discrete choice (multinomial logit) model  
Dependent variable Choice  
Log likelihood function -6169.59788  
Estimation based on N = 5168, K = 7  
Inf.Cr.AIC = 12353.2 AIC/N = 2.390  
Model estimated: Jul 02, 2020, 13:34:21  
R2=1-LogL/LogL\* Log-L fncn R-sqrd R2Adj  
Constants only must be computed directly  
Use NLOGIT ;...;RHS=ONE\$  
Response data are given as ind. choices  
Number of obs.= 5168, skipped 0 obs  
-----+

-----  
--

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
CSTA 1	1.50800***	.08136	18.53	.0000	1.34853	1.66747
CSTB 1	.41312***	.08194	5.04	.0000	.25252	.57371
CSTC 1	.27535***	.07945	3.47	.0005	.11963	.43107
CSTD 1	-.12704	.08524	-1.49	.1361	-.29410	.04002
CSTE 1	.25096***	.08053	3.12	.0018	.09312	.40881
CSTF 1	-.03814***	.00830	-4.59	.0000	-.05442	-.02187
ASCD 1	.36529***	.12958	2.82	.0048	.11132	.61925

-----+

-----  
--  
Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.  
-----

-----  
--  
Line search at iteration 61 does not improve fn. Exiting optimization.  
-----

-----  
--  
Latent Class Logit Model  
Dependent variable CHOICE  
Log likelihood function -5350.22510  
Restricted log likelihood -7164.36926  
Chi squared [ 25 d.f.] 3628.28833  
Significance level .00000  
McFadden Pseudo R-squared .2532176  
Estimation based on N = 5168, K = 25  
Inf.Cr.AIC = 10750.5 AIC/N = 2.080  
Model estimated: Jul 02, 2020, 13:34:29  
Constants only must be computed directly  
Use NLOGIT ;...;RHS=ONE\$  
At start values -6169.6289 .1328\*\*\*\*\*  
Response data are given as ind. choices  
Number of latent classes = 3  
Average Class Probabilities  
.307 .419 .274  
LCM model with panel has 646 groups  
Fixed number of obsrvs./group= 8  
Number of obs.= 5168, skipped 0 obs  
-----+

-----  
--  
| Standard Prob. 95% Confidence

CHOICE	Coefficient	Error	z	z >Z*	Interval	
-----+-----						
--						
Utility parameters in latent class -->> 1						
CSTA 1	.84861***	.15809	5.37	.0000	.53875	1.15846
CSTB 1	1.00840***	.15868	6.36	.0000	.69740	1.31940
CSTC 1	1.11614***	.16818	6.64	.0000	.78651	1.44576
CSTD 1	.80333***	.17681	4.54	.0000	.45679	1.14986
CSTE 1	.85449***	.15832	5.40	.0000	.54418	1.16480
CSTF 1	-.07533***	.01684	-4.47	.0000	-.10834	-.04232
ASCD 1	-.90299***	.31203	-2.89	.0038	-1.51456	-.29143
Utility parameters in latent class -->> 2						
CSTA 2	2.58487***	.21038	12.29	.0000	2.17254	2.99720
CSTB 2	-.01868	.20105	-.09	.9260	-.41273	.37537
CSTC 2	-.14371	.17663	-.81	.4159	-.48989	.20248
CSTD 2	-.68782***	.20138	-3.42	.0006	-1.08252	-.29313
CSTE 2	.15173	.18786	.81	.4193	-.21646	.51992
CSTF 2	-.00477	.01984	-.24	.8099	-.04366	.03411
ASCD 2	-.62797*	.34215	-1.84	.0664	-1.29857	.04262
Utility parameters in latent class -->> 3						
CSTA 3	1.86290***	.19843	9.39	.0000	1.47398	2.25182
CSTB 3	.20249	.18777	1.08	.2808	-.16553	.57051
CSTC 3	-.40070**	.19740	-2.03	.0424	-.78760	-.01379
CSTD 3	-1.11150***	.20759	-5.35	.0000	-1.51838	-.70463
CSTE 3	-.61934***	.19755	-3.14	.0017	-1.00653	-.23214
CSTF 3	-.07383***	.01848	-4.00	.0001	-.11004	-.03762
ASCD 3	.86342***	.30957	2.79	.0053	.25667	1.47017
This is THETA(01) in class probability model.						
Constant	.13799	.12099	1.14	.2541	-.09914	.37513
_PROFB 1	-.40841	.39109	-1.04	.2964	-1.17493	.35812
This is THETA(02) in class probability model.						
Constant	.44873***	.11845	3.79	.0002	.21658	.68087
_PROFB 2	-.40419	.39108	-1.03	.3014	-1.17068	.36230
This is THETA(03) in class probability model.						
Constant	0.0	.....(Fixed Parameter).....				
_PROFB 3	0.0	.....(Fixed Parameter).....				
-----+-----						

--

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.  
Fixed parameter ... is constrained to equal the value or  
had a nonpositive st.error because of an earlier problem.

-----

```
--
|->
|-> Wald;
    Pts=1000;
    Labels =
    b1,    b2,    b3,    b4,    b5,    b6,    a1,
    c1,    c2,    c3,    c4,    c5,    c6,    a2,
    d1,    d2,    d3,    d4,    d5,    d6,    a3,
    e1,e2,e3,e4,e5,e6;
    Start =          b;
    Var    =          varb;
    Fn1    =          b1/b6;
    Fn2    =          b2/b6;
    Fn3    =          b3/b6;
    Fn4    =          b4/b6;
    Fn5    =          b5/b6;
    Fn6    =          c1/c6;
    Fn7    =          c2/c6;
```

```

Fn8    =      c3/c6;
Fn9    =      c4/c6;
Fn10   =      c5/c6;
Fn11   =      d1/d6;
Fn12   =      d2/d6;
Fn13   =      d3/d6;
Fn14   =      d4/d6;
Fn15   =      d5/d6$;

```

```

-----
--
WALD procedure. Estimates and standard errors
for nonlinear functions and joint test of
nonlinear restrictions.
Wald Statistic          =      245.87924
Prob. from Chi-squared[15] =      .00000
Functions are computed at means of variables
-----+-----

```

```

--

```

	WaldFcns	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Fn(1)		-11.2651***	1.14886	-9.81	.0000	-13.5168	-9.0133
Fn(2)		-13.3863***	1.41755	-9.44	.0000	-16.1646	-10.6079
Fn(3)		-14.8165***	1.58039	-9.38	.0000	-17.9140	-11.7190
Fn(4)		-10.6640***	1.04277	-10.23	.0000	-12.7078	-8.6202
Fn(5)		-11.3432***	1.13913	-9.96	.0000	-13.5758	-9.1105
Fn(6)		-541.657	2217.138	-.24	.8070	-4887.167	3803.853
Fn(7)		3.91428	57.17742	.07	.9454	-108.15141	115.97997
Fn(8)		30.1134	158.8355	.19	.8496	-281.1984	341.4251
Fn(9)		144.133	637.8124	.23	.8212	-1105.957	1394.222
Fn(10)		-31.7950	98.48693	-.32	.7468	-224.8258	161.2358
Fn(11)		-25.2323***	4.79998	-5.26	.0000	-34.6401	-15.8245
Fn(12)		-2.74270	2.05832	-1.33	.1827	-6.77693	1.29152
Fn(13)		5.42730	3.80707	1.43	.1540	-2.03442	12.88901
Fn(14)		15.0549**	6.13472	2.45	.0141	3.0311	27.0787
Fn(15)		8.38866*	4.49592	1.87	.0621	-.42318	17.20051

```

-----+-----
--

```

```

--
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
-----

```

```

--
|-> NLOGIT;
Lhs      =      choice,      cset,      alti;
Choices  =      a,          b,          c,          d;
Model:
U(a)=  csta*ATTB_A      +      csta*ATTB_B      +
      cstc*ATTB_C      +      cstd*ATTB_D      +
      cste*ATTB_E      +      cstf*cost/
U(b)=  csta*ATTB_A      +      csta*ATTB_B      +
      cstc*ATTB_C      +      cstd*ATTB_D      +
      cste*ATTB_E      +      cstf*cost/
U(c)=  csta*ATTB_A      +      csta*ATTB_B      +
      cstc*ATTB_C      +      cstd*ATTB_D      +
      cste*ATTB_E      +      cstf*cost/
U(d)=  ascd;
LCM=  JOBBLANK;
parameters;
pts=3;

```

Pds = 8\$;  
 Normal exit: 5 iterations. Status=0, F= 6169.598

```
-----
--
Discrete choice (multinomial logit) model
Dependent variable      Choice
Log likelihood function  -6169.59788
Estimation based on N = 5168, K = 7
Inf.Cr.AIC = 12353.2 AIC/N = 2.390
Model estimated: Jul 02, 2020, 13:34:30
R2=1-LogL/LogL* Log-L fncn R-sqrd R2Adj
Constants only must be computed directly
      Use NLOGIT ;...;RHS=ONE$
Response data are given as ind. choices
Number of obs.= 5168, skipped 0 obs
-----
+
```

```
-----
--
```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
CSTA 1	1.50800***	.08136	18.53	.0000	1.34853	1.66747
CSTB 1	.41312***	.08194	5.04	.0000	.25252	.57371
CSTC 1	.27535***	.07945	3.47	.0005	.11963	.43107
CSTD 1	-.12704	.08524	-1.49	.1361	-.29410	.04002
CSTE 1	.25096***	.08053	3.12	.0018	.09312	.40881
CSTF 1	-.03814***	.00830	-4.59	.0000	-.05442	-.02187
ASCD 1	.36529***	.12958	2.82	.0048	.11132	.61925

```
-----
+
```

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

Line search at iteration 60 does not improve fn. Exiting optimization.

```
-----
--
Latent Class Logit Model
Dependent variable      CHOICE
Log likelihood function  -5378.93839
Restricted log likelihood -7164.36926
Chi squared [ 25 d.f.]  3570.86174
Significance level      .00000
McFadden Pseudo R-squared .2492098
Estimation based on N = 5168, K = 25
Inf.Cr.AIC = 10807.9 AIC/N = 2.091
Model estimated: Jul 02, 2020, 13:34:52
Constants only must be computed directly
      Use NLOGIT ;...;RHS=ONE$
At start values -6169.6289 .1282*****
Response data are given as ind. choices
Number of latent classes = 3
Average Class Probabilities
      .266 .447 .286
LCM model with panel has 646 groups
Fixed number of obsrvs./group= 8
Number of obs.= 5168, skipped 0 obs
-----
+
```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
-----+-----						
--						
Utility parameters in latent class --> 1						
CSTA 1	.59460***	.17453	3.41	.0007	.25253	.93667
CSTB 1	1.05813***	.17578	6.02	.0000	.71360	1.40266
CSTC 1	1.23017***	.18581	6.62	.0000	.86599	1.59435
CSTD 1	.88270***	.19210	4.59	.0000	.50619	1.25921
CSTE 1	.94062***	.17451	5.39	.0000	.59858	1.28266
CSTF 1	-.08856***	.01861	-4.76	.0000	-.12504	-.05207
ASCD 1	-1.60400***	.40673	-3.94	.0001	-2.40118	-.80682
Utility parameters in latent class --> 2						
CSTA 2	2.57283***	.19314	13.32	.0000	2.19428	2.95137
CSTB 2	.04478	.18766	.24	.8114	-.32302	.41258
CSTC 2	.08904	.16643	.53	.5927	-.23716	.41523
CSTD 2	-.58213***	.18821	-3.09	.0020	-.95101	-.21325
CSTE 2	.27713	.17515	1.58	.1136	-.06615	.62041
CSTF 2	-.01643	.01856	-.89	.3760	-.05280	.01994
ASCD 2	-.38251	.31208	-1.23	.2203	-.99418	.22916
Utility parameters in latent class --> 3						
CSTA 3	1.62258***	.19344	8.39	.0000	1.24344	2.00172
CSTB 3	.11778	.19056	.62	.5365	-.25572	.49127
CSTC 3	-.59632***	.19982	-2.98	.0028	-.98796	-.20468
CSTD 3	-1.32334***	.21161	-6.25	.0000	-1.73808	-.90860
CSTE 3	-.72398***	.19677	-3.68	.0002	-1.10964	-.33832
CSTF 3	-.07291***	.01804	-4.04	.0001	-.10827	-.03754
ASCD 3	.37544	.31314	1.20	.2305	-.23830	.98919
This is THETA(01) in class probability model.						
Constant	.00226	.12318	.02	.9854	-.23917	.24369
_JOBBL 1	-1.66992***	.37390	-4.47	.0000	-2.40275	-.93709
This is THETA(02) in class probability model.						
Constant	.48409***	.11854	4.08	.0000	.25176	.71642
_JOBBL 2	-.55273	.37385	-1.48	.1393	-1.28547	.18000
This is THETA(03) in class probability model.						
Constant	0.0	.....(Fixed Parameter).....				
_JOBBL 3	0.0	.....(Fixed Parameter).....				
-----+-----						

--

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.  
Fixed parameter ... is constrained to equal the value or  
had a nonpositive st.error because of an earlier problem.

-----

--

```

|->
|-> Wald;
    Pts=1000;
    Labels =
    b1,    b2,    b3,    b4,    b5,    b6,    a1,
    c1,    c2,    c3,    c4,    c5,    c6,    a2,
    d1,    d2,    d3,    d4,    d5,    d6,    a3,
    e1,e2,e3,e4,e5,e6;
    Start =          b;
    Var    =          varb;
    Fn1    =          b1/b6;
    Fn2    =          b2/b6;
    Fn3    =          b3/b6;
    Fn4    =          b4/b6;
    Fn5    =          b5/b6;
    Fn6    =          c1/c6;

```

```

Fn7   =      c2/c6;
Fn8   =      c3/c6;
Fn9   =      c4/c6;
Fn10  =      c5/c6;
Fn11  =      d1/d6;
Fn12  =      d2/d6;
Fn13  =      d3/d6;
Fn14  =      d4/d6;
Fn15  =      d5/d6$;

```

```

-----
--
WALD procedure. Estimates and standard errors
for nonlinear functions and joint test of
nonlinear restrictions.
Wald Statistic           =      359.37358
Prob. from Chi-squared[15] =      .00000
Functions are computed at means of variables
-----

```

```

-----
--

```

WaldFcns	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Fncn(1)	-6.71425***	.93720	-7.16	.0000	-8.55112	-4.87738
Fncn(2)	-11.9484***	1.08849	-10.98	.0000	-14.0818	-9.8150
Fncn(3)	-13.8911***	1.31285	-10.58	.0000	-16.4643	-11.3180
Fncn(4)	-9.96747***	.92163	-10.82	.0000	-11.77383	-8.16111
Fncn(5)	-10.6215***	.94601	-11.23	.0000	-12.4756	-8.7673
Fncn(6)	-156.627	167.7259	-.93	.3504	-485.364	172.109
Fncn(7)	-2.72604	8.76260	-.31	.7557	-19.90042	14.44834
Fncn(8)	-5.42049	5.55186	-.98	.3289	-16.30193	5.46095
Fncn(9)	35.4387	50.65068	.70	.4841	-63.8348	134.7122
Fncn(10)	-16.8710	10.69140	-1.58	.1146	-37.8257	4.0838
Fncn(11)	-22.2556***	4.05238	-5.49	.0000	-30.1981	-14.3131
Fncn(12)	-1.61547	2.31897	-.70	.4860	-6.16057	2.92963
Fncn(13)	8.17923*	4.44705	1.84	.0659	-.53684	16.89529
Fncn(14)	18.1512***	6.88887	2.63	.0084	4.6493	31.6531
Fncn(15)	9.93021**	4.85628	2.04	.0409	.41208	19.44835

```

-----
--

```

```

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
-----

```

```

--
|-> NLOGIT;
Lhs = choice, cset, alti;
Choices = a, b, c, d;
Model:
U(a)= csta*ATTB_A + cstb*ATTB_B +
      cstc*ATTB_C + cstd*ATTB_D +
      cste*ATTB_E + cstf*cost/
U(b)= csta*ATTB_A + cstb*ATTB_B +
      cstc*ATTB_C + cstd*ATTB_D +
      cste*ATTB_E + cstf*cost/
U(c)= csta*ATTB_A + cstb*ATTB_B +
      cstc*ATTB_C + cstd*ATTB_D +
      cste*ATTB_E + cstf*cost/
U(d)= ascd;
LCM= JOBUNEM;
parameters;

```



```

pts=3;
Pds = 8$;
Normal exit: 5 iterations. Status=0, F= 6169.598

```

```

-----
--
Discrete choice (multinomial logit) model
Dependent variable      Choice
Log likelihood function -6169.59788
Estimation based on N = 5168, K = 7
Inf.Cr.AIC = 12353.2 AIC/N = 2.390
Model estimated: Jul 02, 2020, 13:34:53
R2=1-LogL/LogL* Log-L fncn R-sqrd R2Adj
Constants only must be computed directly
      Use NLOGIT ;...;RHS=ONE$
Response data are given as ind. choices
Number of obs.= 5168, skipped 0 obs
-----+-----

```

```

--

```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
CSTA 1	1.50800***	.08136	18.53	.0000	1.34853	1.66747
CSTB 1	.41312***	.08194	5.04	.0000	.25252	.57371
CSTC 1	.27535***	.07945	3.47	.0005	.11963	.43107
CSTD 1	-.12704	.08524	-1.49	.1361	-.29410	.04002
CSTE 1	.25096***	.08053	3.12	.0018	.09312	.40881
CSTF 1	-.03814***	.00830	-4.59	.0000	-.05442	-.02187
ASCD 1	.36529***	.12958	2.82	.0048	.11132	.61925

```

-----+-----

```

```

--
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
-----

```

```

--
Line search at iteration 29 does not improve fn. Exiting optimization.
-----

```

```

--
Latent Class Logit Model
Dependent variable      CHOICE
Log likelihood function -5512.47638
Restricted log likelihood -7164.36926
Chi squared [ 25 d.f.] 3303.78577
Significance level      .00000
McFadden Pseudo R-squared .2305706
Estimation based on N = 5168, K = 25
Inf.Cr.AIC = 11075.0 AIC/N = 2.143
Model estimated: Jul 02, 2020, 13:35:03
Constants only must be computed directly
      Use NLOGIT ;...;RHS=ONE$
At start values -6169.6289 .1065*****
Response data are given as ind. choices
Number of latent classes = 3
Average Class Probabilities
      .566 .319 .115
LCM model with panel has 646 groups
Fixed number of obsrvs./group= 8
BHHH estimator used for asymp. variance
Number of obs.= 5168, skipped 0 obs

```

```

-----+-----
--
|
CHOICE| Coefficient      Standard      Prob.      95% Confidence
      |      Error        z        |z|>Z*      Interval
-----+-----
--
|Utility parameters in latent class -->> 1
CSTA|1| 1.03823***      .12928      8.03      .0000      .78484      1.29162
CSTB|1| .33153***      .12292      2.70      .0070      .09062      .57244
CSTC|1| .28787**      .12009      2.40      .0165      .05250      .52325
CSTD|1| -.01731      .12803      -1.14     .8925     -.26825     .23363
CSTE|1| .32234***      .12381      2.60      .0092      .07969      .56500
CSTF|1| -.01255      .01266      -0.99     .3214     -.03737     .01226
ASCD|1| -2.02473***     .25373     -7.98     .0000     -2.52203    -1.52743
|Utility parameters in latent class -->> 2
CSTA|2| 3.63649***     .23045     15.78     .0000     3.18480     4.08817
CSTB|2| .97961***     .22169     4.42     .0000     .54510     1.41411
CSTC|2| .84997***     .18915     4.49     .0000     .47924     1.22070
CSTD|2| .61193***     .21608     2.83     .0046     .18841     1.03544
CSTE|2| .63836***     .20175     3.16     .0016     .24294     1.03378
CSTF|2| -.15104***     .01994     -7.57     .0000     -.19012     -.11195
ASCD|2| 2.18293***     .33905     6.44     .0000     1.51841     2.84746
|Utility parameters in latent class -->> 3
CSTA|3| 1.63836***     .31111     5.27     .0000     1.02859     2.24814
CSTB|3| .45438      .31983     1.42     .1554     -.17247     1.08123
CSTC|3| -.34014     .31915     -1.07     .2865     -.96567     .28539
CSTD|3| -1.18872***     .33103     -3.59     .0003     -1.83752     -.53991
CSTE|3| -.47004     .30159     -1.56     .1191     -1.06115     .12107
CSTF|3| -.03702     .02823     -1.31     .1898     -.09235     .01832
ASCD|3| 1.75814***     .49997     3.52     .0004     .77823     2.73805
|This is THETA(01) in class probability model.
Constant| 1.61264***     .16639     9.69     .0000     1.28651     1.93876
_JOBUN|1| -.46932      .80849     -.58     .5616     -2.05393     1.11529
|This is THETA(02) in class probability model.
Constant| 1.06242***     .20112     5.28     .0000     .66824     1.45661
_JOBUN|2| -2.39242***     .80847     -2.96     .0031     -3.97699     -.80785
|This is THETA(03) in class probability model.
Constant| 0.0      .....(Fixed Parameter).....
_JOBUN|3| 0.0      .....(Fixed Parameter).....
-----+-----
--

```

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.  
Fixed parameter ... is constrained to equal the value or  
had a nonpositive st.error because of an earlier problem.

```

--
|->
|-> Wald;
    Pts=1000;
    Labels =
    b1,    b2,    b3,    b4,    b5,    b6,    a1,
    c1,    c2,    c3,    c4,    c5,    c6,    a2,
    d1,    d2,    d3,    d4,    d5,    d6,    a3,
    e1,e2,e3,e4,e5,e6;
    Start =      b;
    Var    =      varb;
    Fn1    =      b1/b6;
    Fn2    =      b2/b6;
    Fn3    =      b3/b6;
    Fn4    =      b4/b6;

```

```

Fn5    =      b5/b6;
Fn6    =      c1/c6;
Fn7    =      c2/c6;
Fn8    =      c3/c6;
Fn9    =      c4/c6;
Fn10   =      c5/c6;
Fn11   =      d1/d6;
Fn12   =      d2/d6;
Fn13   =      d3/d6;
Fn14   =      d4/d6;
Fn15   =      d5/d6$;

```

```

-----
--
WALD procedure. Estimates and standard errors
for nonlinear functions and joint test of
nonlinear restrictions.
Wald Statistic           =      804.70350
Prob. from Chi-squared[15] =      .00000
Functions are computed at means of variables
-----

```

WaldFcns	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Fncn(1)	-82.7059	73.66210	-1.12	.2615	-227.0810	61.6691
Fncn(2)	-26.4096	17.57043	-1.50	.1328	-60.8470	8.0278
Fncn(3)	-22.9322	14.53512	-1.58	.1146	-51.4205	5.5561
Fncn(4)	1.37873	11.52543	.12	.9048	-21.21070	23.96815
Fncn(5)	-25.6779	16.78164	-1.53	.1260	-58.5693	7.2135
Fncn(6)	-24.0770***	2.14413	-11.23	.0000	-28.2794	-19.8745
Fncn(7)	-6.48592***	.78419	-8.27	.0000	-8.02290	-4.94894
Fncn(8)	-5.62761***	.74295	-7.57	.0000	-7.08377	-4.17146
Fncn(9)	-4.05153***	.99844	-4.06	.0000	-6.00844	-2.09462
Fncn(10)	-4.22655***	.85944	-4.92	.0000	-5.91103	-2.54207
Fncn(11)	-44.2612	28.66667	-1.54	.1226	-100.4468	11.9245
Fncn(12)	-12.2753**	5.34324	-2.30	.0216	-22.7479	-1.8027
Fncn(13)	9.18900	14.92588	.62	.5381	-20.06518	38.44318
Fncn(14)	32.1138	31.71476	1.01	.3113	-30.0460	94.2735
Fncn(15)	12.6984	17.29970	.73	.4629	-21.2084	46.6052

```

--
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
-----

```

```

|--> NLOGIT;
Lhs      =      choice,      cset,      alti;
Choices  =      a,          b,          c,          d;
Model:
U(a)=  csta*ATTB_A      +      cstb*ATTB_B      +
      cstc*ATTB_C      +      cstd*ATTB_D      +
      cste*ATTB_E      +      cstf*cost/
U(b)=  csta*ATTB_A      +      cstb*ATTB_B      +
      cstc*ATTB_C      +      cstd*ATTB_D      +
      cste*ATTB_E      +      cstf*cost/
U(c)=  csta*ATTB_A      +      cstb*ATTB_B      +
      cstc*ATTB_C      +      cstd*ATTB_D      +
      cste*ATTB_E      +      cstf*cost/
U(d)=  ascd;

```

```

LCM= JOBSELF;
parameters;
pts=3;
Pds      =          8$;
Normal exit:  5 iterations. Status=0, F=      6169.598

```

```

-----
--
Discrete choice (multinomial logit) model
Dependent variable      Choice
Log likelihood function  -6169.59788
Estimation based on N =  5168, K =   7
Inf.Cr.AIC = 12353.2 AIC/N =   2.390
Model estimated: Jul 02, 2020, 13:35:04
R2=1-LogL/LogL* Log-L fncn R-sqrd R2Adj
Constants only must be computed directly
          Use NLOGIT ;...;RHS=ONE$
Response data are given as ind. choices
Number of obs.=  5168, skipped   0 obs
-----

```

```

--

```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
CSTA 1	1.50800***	.08136	18.53	.0000	1.34853	1.66747
CSTB 1	.41312***	.08194	5.04	.0000	.25252	.57371
CSTC 1	.27535***	.07945	3.47	.0005	.11963	.43107
CSTD 1	-.12704	.08524	-1.49	.1361	-.29410	.04002
CSTE 1	.25096***	.08053	3.12	.0018	.09312	.40881
CSTF 1	-.03814***	.00830	-4.59	.0000	-.05442	-.02187
ASCD 1	.36529***	.12958	2.82	.0048	.11132	.61925

```

-----

```

```

--
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
-----

```

```

Line search at iteration  64 does not improve fn. Exiting optimization.
-----

```

```

--
Latent Class Logit Model
Dependent variable      CHOICE
Log likelihood function  -5350.43499
Restricted log likelihood -7164.36926
Chi squared [ 25 d.f.]   3627.86854
Significance level       .00000
McFadden Pseudo R-squared .2531883
Estimation based on N =  5168, K =  25
Inf.Cr.AIC = 10750.9 AIC/N =   2.080
Model estimated: Jul 02, 2020, 13:35:18
Constants only must be computed directly
          Use NLOGIT ;...;RHS=ONE$
At start values -6169.6289 .1328*****
Response data are given as ind. choices
Number of latent classes =  3
Average Class Probabilities
          .309 .417 .274
LCM model with panel has  646 groups
Fixed number of obsrvs./group=  8

```

Number of obs.= 5168, skipped 0 obs

```
-----+-----
```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
-----+-----						
--						
Utility parameters in latent class -->> 1						
CSTA 1	.81074***	.15651	5.18	.0000	.50399	1.11749
CSTB 1	.99167***	.15753	6.30	.0000	.68292	1.30042
CSTC 1	1.08107***	.16434	6.58	.0000	.75898	1.40316
CSTD 1	.78891***	.17446	4.52	.0000	.44698	1.13085
CSTE 1	.85465***	.15576	5.49	.0000	.54937	1.15993
CSTF 1	-.07292***	.01646	-4.43	.0000	-.10518	-.04067
ASCD 1	-.96244***	.30829	-3.12	.0018	-1.56668	-.35821
Utility parameters in latent class -->> 2						
CSTA 2	2.55511***	.20872	12.24	.0000	2.14603	2.96419
CSTB 2	-.05690	.20078	-.28	.7769	-.45041	.33661
CSTC 2	-.14933	.17646	-.85	.3974	-.49519	.19654
CSTD 2	-.72387***	.20121	-3.60	.0003	-1.11824	-.32950
CSTE 2	.12305	.18735	.66	.5113	-.24416	.49025
CSTF 2	-.00061	.01980	-.03	.9755	-.03942	.03820
ASCD 2	-.64300*	.34009	-1.89	.0587	-1.30957	.02357
Utility parameters in latent class -->> 3						
CSTA 3	1.86743***	.19538	9.56	.0000	1.48450	2.25036
CSTB 3	.21503	.18847	1.14	.2539	-.15436	.58442
CSTC 3	-.39214**	.19695	-1.99	.0465	-.77816	-.00613
CSTD 3	-1.10206***	.20624	-5.34	.0000	-1.50627	-.69784
CSTE 3	-.61322***	.19654	-3.12	.0018	-.99842	-.22801
CSTF 3	-.07342***	.01840	-3.99	.0001	-.10949	-.03735
ASCD 3	.87803***	.30770	2.85	.0043	.27494	1.48112
This is THETA(01) in class probability model.						
Constant	.14691	.12609	1.17	.2440	-.10022	.39405
_JOBSE 1	-.18522	.25272	-.73	.4636	-.68055	.31011
This is THETA(02) in class probability model.						
Constant	.43753***	.12576	3.48	.0005	.19105	.68401
_JOBSE 2	-.09363	.25259	-.37	.7109	-.58871	.40144
This is THETA(03) in class probability model.						
Constant	0.0	..... (Fixed Parameter) .....				
_JOBSE 3	0.0	..... (Fixed Parameter) .....				

```
-----+-----
```

--  
Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.  
Fixed parameter ... is constrained to equal the value or  
had a nonpositive st.error because of an earlier problem.  
-----+-----

```
--
|->
|-> Wald;
    Pts=1000;
    Labels =
    b1,    b2,    b3,    b4,    b5,    b6,    a1,
    c1,    c2,    c3,    c4,    c5,    c6,    a2,
    d1,    d2,    d3,    d4,    d5,    d6,    a3,
    e1,e2,e3,e4,e5,e6;
    Start =          b;
    Var    =          varb;
    Fn1    =          b1/b6;
    Fn2    =          b2/b6;
    Fn3    =          b3/b6;
```

```

Fn4    =      b4/b6;
Fn5    =      b5/b6;
Fn6    =      c1/c6;
Fn7    =      c2/c6;
Fn8    =      c3/c6;
Fn9    =      c4/c6;
Fn10   =      c5/c6;
Fn11   =      d1/d6;
Fn12   =      d2/d6;
Fn13   =      d3/d6;
Fn14   =      d4/d6;
Fn15   =      d5/d6$;

```

```

-----
--
WALD procedure. Estimates and standard errors
for nonlinear functions and joint test of
nonlinear restrictions.
Wald Statistic          =      238.46827
Prob. from Chi-squared[15] =      .00000
Functions are computed at means of variables
-----

```

WaldFcns	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Fncn(1)	-11.1177***	1.14171	-9.74	.0000	-13.3554	-8.8800
Fncn(2)	-13.5988***	1.44747	-9.39	.0000	-16.4358	-10.7618
Fncn(3)	-14.8248***	1.61566	-9.18	.0000	-17.9914	-11.6582
Fncn(4)	-10.8184***	1.07000	-10.11	.0000	-12.9156	-8.7213
Fncn(5)	-11.7199***	1.21142	-9.67	.0000	-14.0942	-9.3455
Fncn(6)	-4199.72	136413.2	-.03	.9754	-271564.78	263165.34
Fncn(7)	93.5235	3343.023	.03	.9777	-6458.6816	6645.7286
Fncn(8)	245.444	8245.482	.03	.9763	-15915.405	16406.292
Fncn(9)	1189.80	39024.26	.03	.9757	-75296.35	77675.94
Fncn(10)	-202.246	6308.125	-.03	.9744	-12565.943	12161.451
Fncn(11)	-25.4341***	4.88078	-5.21	.0000	-35.0003	-15.8680
Fncn(12)	-2.92865	2.04799	-1.43	.1527	-6.94264	1.08533
Fncn(13)	5.34093	3.80132	1.41	.1600	-2.10951	12.79137
Fncn(14)	15.0098**	6.14182	2.44	.0145	2.9721	27.0476
Fncn(15)	8.35193*	4.50745	1.85	.0639	-.48251	17.18638

```

-----
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
-----

```

```

|-> NLOGIT;
Lhs    =      choice,      cset,      alti;
Choices =      =,         a,         b,         c,         d;
Model:
U(a) =  csta*ATTB_A      +      cstb*ATTB_B      +
        cstc*ATTB_C      +      cstd*ATTB_D      +
        cste*ATTB_E      +      cstf*cost/
U(b) =  csta*ATTB_A      +      cstb*ATTB_B      +
        cstc*ATTB_C      +      cstd*ATTB_D      +
        cste*ATTB_E      +      cstf*cost/
U(c) =  csta*ATTB_A      +      cstb*ATTB_B      +
        cstc*ATTB_C      +      cstd*ATTB_D      +
        cste*ATTB_E      +      cstf*cost/

```

```

U(d)= ascd;
LCM= JOBRET;
parameters;
pts=3;
Pds = 8$;

```

Normal exit: 5 iterations. Status=0, F= 6169.598

```

-----
--
Discrete choice (multinomial logit) model
Dependent variable      Choice
Log likelihood function -6169.59788
Estimation based on N = 5168, K = 7
Inf.Cr.AIC = 12353.2 AIC/N = 2.390
Model estimated: Jul 02, 2020, 13:35:19
R2=1-LogL/LogL* Log-L fncn R-sqrd R2Adj
Constants only must be computed directly
      Use NLOGIT ;...;RHS=ONE$
Response data are given as ind. choices
Number of obs.= 5168, skipped 0 obs
-----

```

```

-----
--

```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
CSTA 1	1.50800***	.08136	18.53	.0000	1.34853	1.66747
CSTB 1	.41312***	.08194	5.04	.0000	.25252	.57371
CSTC 1	.27535***	.07945	3.47	.0005	.11963	.43107
CSTD 1	-.12704	.08524	-1.49	.1361	-.29410	.04002
CSTE 1	.25096***	.08053	3.12	.0018	.09312	.40881
CSTF 1	-.03814***	.00830	-4.59	.0000	-.05442	-.02187
ASCD 1	.36529***	.12958	2.82	.0048	.11132	.61925

```

-----

```

```

--
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
-----

```

```

--
Line search at iteration 16 does not improve fn. Exiting optimization.
-----

```

```

--
Latent Class Logit Model
Dependent variable      CHOICE
Log likelihood function -5599.83995
Restricted log likelihood -7164.36926
Chi squared [ 25 d.f.] 3129.05861
Significance level      .00000
McFadden Pseudo R-squared .2183764
Estimation based on N = 5168, K = 25
Inf.Cr.AIC = 11249.7 AIC/N = 2.177
Model estimated: Jul 02, 2020, 13:35:23
Constants only must be computed directly
      Use NLOGIT ;...;RHS=ONE$
At start values -6169.6289 .0924*****
Response data are given as ind. choices
Number of latent classes = 3
Average Class Probabilities
      .717 .080 .203
LCM model with panel has 646 groups

```

Fixed number of obsrvs./group= 8  
 BHHH estimator used for asymp. variance  
 Number of obs.= 5168, skipped 0 obs

```
-----+-----
```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
-----+-----						
--						
Utility parameters in latent class -->> 1						
CSTA 1	1.45841***	.10421	13.99	.0000	1.25415	1.66267
CSTB 1	.42725***	.10544	4.05	.0001	.22058	.63392
CSTC 1	.31829***	.10216	3.12	.0018	.11806	.51852
CSTD 1	.05294	.10837	.49	.6252	-.15946	.26534
CSTE 1	.46913***	.10562	4.44	.0000	.26211	.67615
CSTF 1	-.02923***	.01069	-2.73	.0062	-.05017	-.00828
ASCD 1	-1.00433***	.18169	-5.53	.0000	-1.36043	-.64823
Utility parameters in latent class -->> 2						
CSTA 2	4.61073***	.67677	6.81	.0000	3.28428	5.93718
CSTB 2	.06732	.62996	.11	.9149	-1.16737	1.30201
CSTC 2	.03713	.55763	.07	.9469	-1.05579	1.13006
CSTD 2	-2.24377***	.64424	-3.48	.0005	-3.50646	-.98107
CSTE 2	-1.01582	.63164	-1.61	.1078	-2.25380	.22216
CSTF 2	-.15323**	.06097	-2.51	.0120	-.27272	-.03373
ASCD 2	1.21162	.96447	1.26	.2090	-.67870	3.10194
Utility parameters in latent class -->> 3						
CSTA 3	1.90123***	.23552	8.07	.0000	1.43962	2.36283
CSTB 3	.19413	.23769	.82	.4141	-.27174	.66000
CSTC 3	-.84960***	.23377	-3.63	.0003	-1.30778	-.39141
CSTD 3	-2.05588***	.24562	-8.37	.0000	-2.53729	-1.57448
CSTE 3	-.88123***	.22291	-3.95	.0001	-1.31812	-.44433
CSTF 3	.05259**	.02111	2.49	.0127	.01122	.09396
ASCD 3	1.68584***	.37723	4.47	.0000	.94649	2.42519
This is THETA(01) in class probability model.						
Constant	1.46784***	.15610	9.40	.0000	1.16189	1.77379
_JOBRE 1	-.99511***	.27212	-3.66	.0003	-1.52846	-.46175
This is THETA(02) in class probability model.						
Constant	-.88401**	.34702	-2.55	.0109	-1.56415	-.20387
_JOBRE 2	-.20179	.27208	-.74	.4583	-.73507	.33148
This is THETA(03) in class probability model.						
Constant	0.0	.....(Fixed Parameter).....				
_JOBRE 3	0.0	.....(Fixed Parameter).....				

```
-----+-----
```

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.  
 Fixed parameter ... is constrained to equal the value or had a nonpositive st.error because of an earlier problem.

```
-----+-----
```

```
--
```

```
|->
```

```
|-> Wald;
```

```
  Pts=1000;
```

```
  Labels =
```

```
  b1,    b2,    b3,    b4,    b5,    b6,    a1,
```

```
  c1,    c2,    c3,    c4,    c5,    c6,    a2,
```

```
  d1,    d2,    d3,    d4,    d5,    d6,    a3,
```

```
  e1,e2,e3,e4,e5,e6;
```

```
  Start =          b;
```

```
  Var   =          varb;
```

```
  Fn1   =          b1/b6;
```



```

Fn2    =      b2/b6;
Fn3    =      b3/b6;
Fn4    =      b4/b6;
Fn5    =      b5/b6;
Fn6    =      c1/c6;
Fn7    =      c2/c6;
Fn8    =      c3/c6;
Fn9    =      c4/c6;
Fn10   =      c5/c6;
Fn11   =      d1/d6;
Fn12   =      d2/d6;
Fn13   =      d3/d6;
Fn14   =      d4/d6;
Fn15   =      d5/d6;

```

```

-----
--
WALD procedure. Estimates and standard errors
for nonlinear functions and joint test of
nonlinear restrictions.
Wald Statistic           =      251.91957
Prob. from Chi-squared[15] =      .00000
Functions are computed at means of variables
-----+-----
--

```

WaldFcns	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Fncn(1)	-49.8988***	14.88201	-3.35	.0008	-79.0670	-20.7306
Fncn(2)	-14.6181***	2.24729	-6.50	.0000	-19.0227	-10.2135
Fncn(3)	-10.8900***	1.42933	-7.62	.0000	-13.6915	-8.0886
Fncn(4)	-1.81127	3.09300	-.59	.5581	-7.87343	4.25089
Fncn(5)	-16.0510***	2.66268	-6.03	.0000	-21.2697	-10.8322
Fncn(6)	-30.0909***	8.25153	-3.65	.0003	-46.2636	-13.9182
Fncn(7)	-.43937	3.95956	-.11	.9116	-8.19996	7.32122
Fncn(8)	-.24235	3.55617	-.07	.9457	-7.21232	6.72762
Fncn(9)	14.6434	9.20805	1.59	.1118	-3.4040	32.6909
Fncn(10)	6.62954	6.31837	1.05	.2941	-5.75423	19.01331
Fncn(11)	36.1506**	17.76456	2.03	.0419	1.3327	70.9685
Fncn(12)	3.69124	5.71081	.65	.5180	-7.50174	14.88422
Fncn(13)	-16.1546***	3.93702	-4.10	.0000	-23.8710	-8.4381
Fncn(14)	-39.0912***	12.81548	-3.05	.0023	-64.2091	-13.9733
Fncn(15)	-16.7559***	4.02353	-4.16	.0000	-24.6419	-8.8699

```

-----+-----
--
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
-----
--

```

```

|-> NLOGIT;
Lhs    =      choice,      cset,      alti;
Choices =      a,          b,          c,          d;
Model:
U(a) =  csta*ATTB_A      +      cstb*ATTB_B      +
        cstc*ATTB_C      +      cstd*ATTB_D      +
        cste*ATTB_E
U(b) =  csta*ATTB_A      +      cstb*ATTB_B      +
        cstc*ATTB_C      +      cstd*ATTB_D      +
        cste*ATTB_E

```

```

U(c)=  csta*ATTB_A      +          cstb*ATTB_B      +
        cstc*ATTB_C      +          cstd*ATTB_D      +
        cste*ATTB_E      +          cstf*cost/
U(d)=  ascd;
LCM=  JOBPNTS;
parameters;
pts=3;
Pds   =          8$;

```

Normal exit: 5 iterations. Status=0, F= 6169.598

-----  
--

Discrete choice (multinomial logit) model

Dependent variable           Choice

Log likelihood function       -6169.59788

Estimation based on N = 5168, K = 7

Inf.Cr.AIC = 12353.2 AIC/N = 2.390

Model estimated: Jul 02, 2020, 13:35:24

R2=1-LogL/LogL\* Log-L fncn R-sqrd R2Adj

Constants only must be computed directly

Use NLOGIT ;...;RHS=ONE\$

Response data are given as ind. choices

Number of obs.= 5168, skipped 0 obs

-----  
--

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
CSTA 1	1.50800***	.08136	18.53	.0000	1.34853	1.66747
CSTB 1	.41312***	.08194	5.04	.0000	.25252	.57371
CSTC 1	.27535***	.07945	3.47	.0005	.11963	.43107
CSTD 1	-.12704	.08524	-1.49	.1361	-.29410	.04002
CSTE 1	.25096***	.08053	3.12	.0018	.09312	.40881
CSTF 1	-.03814***	.00830	-4.59	.0000	-.05442	-.02187
ASCD 1	.36529***	.12958	2.82	.0048	.11132	.61925

-----  
--

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

-----  
--

Line search at iteration 72 does not improve fn. Exiting optimization.

-----  
--

Latent Class Logit Model

Dependent variable           CHOICE

Log likelihood function       -5350.62048

Restricted log likelihood     -7164.36926

Chi squared [ 25 d.f.]       3627.49756

Significance level           .00000

McFadden Pseudo R-squared   .2531624

Estimation based on N = 5168, K = 25

Inf.Cr.AIC = 10751.2 AIC/N = 2.080

Model estimated: Jul 02, 2020, 13:35:44

Constants only must be computed directly

Use NLOGIT ;...;RHS=ONE\$

At start values -6169.6289 .1327\*\*\*\*\*

Response data are given as ind. choices

Number of latent classes = 3

Average Class Probabilities

.310 .414 .276  
 LCM model with panel has 646 groups  
 Fixed number of obsrvs./group= 8  
 Number of obs.= 5168, skipped 0 obs

```
-----+-----
```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
-----+-----						
--						
Utility parameters in latent class -->> 1						
CSTA 1	.81098***	.15623	5.19	.0000	.50476	1.11719
CSTB 1	.98502***	.15716	6.27	.0000	.67699	1.29306
CSTC 1	1.07848***	.16398	6.58	.0000	.75709	1.39987
CSTD 1	.78133***	.17454	4.48	.0000	.43923	1.12343
CSTE 1	.85187***	.15536	5.48	.0000	.54736	1.15638
CSTF 1	-.07235***	.01642	-4.41	.0000	-.10453	-.04016
ASCD 1	-.96500***	.30758	-3.14	.0017	-1.56785	-.36215
Utility parameters in latent class -->> 2						
CSTA 2	2.55740***	.20999	12.18	.0000	2.14582	2.96898
CSTB 2	-.06035	.20173	-.30	.7648	-.45573	.33503
CSTC 2	-.16231	.17739	-.92	.3602	-.50998	.18536
CSTD 2	-.73438***	.20239	-3.63	.0003	-1.13106	-.33770
CSTE 2	.11377	.18839	.60	.5459	-.25547	.48301
CSTF 2	-.90367D-05	.01990	.00	.9996	-.39019D-01	.39001D-01
ASCD 2	-.66821*	.34288	-1.95	.0513	-1.34025	.00383
Utility parameters in latent class -->> 3						
CSTA 3	1.86293***	.19487	9.56	.0000	1.48099	2.24488
CSTB 3	.22166	.18698	1.19	.2358	-.14481	.58813
CSTC 3	-.38972**	.19631	-1.99	.0471	-.77447	-.00496
CSTD 3	-1.09784***	.20587	-5.33	.0000	-1.50133	-.69435
CSTE 3	-.61210***	.19626	-3.12	.0018	-.99677	-.22743
CSTF 3	-.07345***	.01833	-4.01	.0001	-.10937	-.03752
ASCD 3	.87746***	.30678	2.86	.0042	.27618	1.47874
This is THETA(01) in class probability model.						
Constant	.11646	.11850	.98	.3257	-.11580	.34873
_JOBPN 1	-.10555	.57299	-.18	.8538	-1.22858	1.01748
This is THETA(02) in class probability model.						
Constant	.40953***	.11680	3.51	.0005	.18061	.63845
_JOBPN 2	-.09368	.57292	-.16	.8701	-1.21659	1.02923
This is THETA(03) in class probability model.						
Constant	0.0	.....(Fixed Parameter).....				
_JOBPN 3	0.0	.....(Fixed Parameter).....				

```
-----+-----
```

--  
 Note: nnnnn.D-xx or D+xx => multiply by 10 to -xx or +xx.  
 Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.  
 Fixed parameter ... is constrained to equal the value or had a nonpositive st.error because of an earlier problem.

```
-----+-----
```

```
--
```

```
|->
```

```
|-> Wald;
```

```
  Pts=1000;
```

```
  Labels =
```

```
  b1,    b2,    b3,    b4,    b5,    b6,    a1,
```

```
  c1,    c2,    c3,    c4,    c5,    c6,    a2,
```

```
  d1,    d2,    d3,    d4,    d5,    d6,    a3,
```

```
  e1,e2,e3,e4,e5,e6;
```

```

Start = b;
Var = varb;
Fn1 = b1/b6;
Fn2 = b2/b6;
Fn3 = b3/b6;
Fn4 = b4/b6;
Fn5 = b5/b6;
Fn6 = c1/c6;
Fn7 = c2/c6;
Fn8 = c3/c6;
Fn9 = c4/c6;
Fn10 = c5/c6;
Fn11 = d1/d6;
Fn12 = d2/d6;
Fn13 = d3/d6;
Fn14 = d4/d6;
Fn15 = d5/d6$;

```

```

-----
--
WALD procedure. Estimates and standard errors
for nonlinear functions and joint test of
nonlinear restrictions.
Wald Statistic = 235.68501
Prob. from Chi-squared[15] = .00000
Functions are computed at means of variables
-----

```

```

-----
--

```

WaldFcns	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Fncn(1)	-11.2096***	1.16264	-9.64	.0000	-13.4884	-8.9309
Fncn(2)	-13.6154***	1.45883	-9.33	.0000	-16.4746	-10.7561
Fncn(3)	-14.9072***	1.64011	-9.09	.0000	-18.1217	-11.6926
Fncn(4)	-10.7998***	1.08020	-10.00	.0000	-12.9170	-8.6827
Fncn(5)	-11.7749***	1.22616	-9.60	.0000	-14.1781	-9.3716
Fncn(6)	-283000	.6310D+09	.00	.9996	-1237047140	1236481138
Fncn(7)	6678.17	.1491D+08	.00	.9996	*****	*****
29231562.36						
Fncn(8)	17961.2	.4007D+08	.00	.9996	-78511911.2	78547833.6
Fncn(9)	81265.8	.1812D+09	.00	.9996	*****	*****
355277309.9						
Fncn(10)	-12589.8	.2805D+08	.00	.9996	-54997162.2	54971982.7
Fncn(11)	-25.3642***	4.84180	-5.24	.0000	-34.8539	-15.8744
Fncn(12)	-3.01795	2.01735	-1.50	.1347	-6.97188	.93599
Fncn(13)	5.30609	3.77823	1.40	.1602	-2.09911	12.71128
Fncn(14)	14.9473**	6.10413	2.45	.0143	2.9834	26.9111
Fncn(15)	8.33385*	4.48661	1.86	.0632	-.45976	17.12745

```

-----
--

```

```

Note: nnnnn.D-xx or D+xx => multiply by 10 to -xx or +xx.
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
-----

```

```

--
|-> NLOGIT;
Lhs = choice, cset, alti;
Choices = a, b, c, d;
Model:

```

```

U(a)=  csta*ATTB_A      +          cstb*ATTB_B      +
       cstc*ATTB_C      +          cstd*ATTB_D      +
       cste*ATTB_E      +          cstf*cost/
U(b)=  csta*ATTB_A      +          cstb*ATTB_B      +
       cstc*ATTB_C      +          cstd*ATTB_D      +
       cste*ATTB_E      +          cstf*cost/
U(c)=  csta*ATTB_A      +          cstb*ATTB_B      +
       cstc*ATTB_C      +          cstd*ATTB_D      +
       cste*ATTB_E      +          cstf*cost/
U(d)=  ascd;
LCM=  JOBOTHER;
parameters;
pts=3;
Pds   =          8$;
Normal exit:  5 iterations. Status=0, F=          6169.598

```

```

-----
--
Discrete choice (multinomial logit) model
Dependent variable          Choice
Log likelihood function     -6169.59788
Estimation based on N =    5168, K =    7
Inf.Cr.AIC = 12353.2 AIC/N =    2.390
Model estimated: Jul 02, 2020, 13:35:45
R2=1-LogL/LogL* Log-L fncn R-sqrd R2Adj
Constants only must be computed directly
          Use NLOGIT ;...;RHS=ONE$
Response data are given as ind. choices
Number of obs.= 5168, skipped    0 obs
-----

```

```

-----
--

```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
CSTA 1	1.50800***	.08136	18.53	.0000	1.34853	1.66747
CSTB 1	.41312***	.08194	5.04	.0000	.25252	.57371
CSTC 1	.27535***	.07945	3.47	.0005	.11963	.43107
CSTD 1	-.12704	.08524	-1.49	.1361	-.29410	.04002
CSTE 1	.25096***	.08053	3.12	.0018	.09312	.40881
CSTF 1	-.03814***	.00830	-4.59	.0000	-.05442	-.02187
ASCD 1	.36529***	.12958	2.82	.0048	.11132	.61925

```

-----
--

```

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

Line search at iteration 35 does not improve fn. Exiting optimization.

```

-----
--
Latent Class Logit Model
Dependent variable          CHOICE
Log likelihood function     -5361.26389
Restricted log likelihood   -7164.36926
Chi squared [ 25 d.f.]     3606.21075
Significance level          .00000
McFadden Pseudo R-squared  .2516768
Estimation based on N =    5168, K =    25
Inf.Cr.AIC = 10772.5 AIC/N =    2.084

```

Model estimated: Jul 02, 2020, 13:35:51  
 Constants only must be computed directly  
 Use NLOGIT ;...;RHS=ONE\$  
 At start values -6169.6289 .1310\*\*\*\*\*  
 Response data are given as ind. choices  
 Number of latent classes = 3  
 Average Class Probabilities  
 .327 .404 .268  
 LCM model with panel has 646 groups  
 Fixed number of obsrvs./group= 8  
 Number of obs.= 5168, skipped 0 obs

```
-----+-----
```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
-----+-----						
--						
Utility parameters in latent class -->> 1						
CSTA 1	.93161***	.16086	5.79	.0000	.61632	1.24690
CSTB 1	1.13000***	.16112	7.01	.0000	.81421	1.44578
CSTC 1	1.19893***	.17056	7.03	.0000	.86462	1.53323
CSTD 1	.96133***	.17946	5.36	.0000	.60959	1.31306
CSTE 1	.95310***	.16048	5.94	.0000	.63856	1.26765
CSTF 1	-.08372***	.01713	-4.89	.0000	-.11728	-.05015
ASCD 1	-1.20899***	.36007	-3.36	.0008	-1.91472	-.50326
Utility parameters in latent class -->> 2						
CSTA 2	2.52041***	.20495	12.30	.0000	2.11872	2.92211
CSTB 2	.01519	.19628	.08	.9383	-.36952	.39989
CSTC 2	-.15722	.17399	-.90	.3662	-.49823	.18378
CSTD 2	-.71832***	.19633	-3.66	.0003	-1.10312	-.33351
CSTE 2	.21492	.18444	1.17	.2439	-.14657	.57641
CSTF 2	.00220	.01936	.11	.9097	-.03575	.04014
ASCD 2	-.34375	.32271	-1.07	.2868	-.97625	.28875
Utility parameters in latent class -->> 3						
CSTA 3	1.70296***	.19621	8.68	.0000	1.31839	2.08752
CSTB 3	-.02003	.18900	-.11	.9156	-.39046	.35039
CSTC 3	-.45819**	.19635	-2.33	.0196	-.84304	-.07335
CSTD 3	-1.15596***	.20740	-5.57	.0000	-1.56245	-.74946
CSTE 3	-.66879***	.19473	-3.43	.0006	-1.05046	-.28711
CSTF 3	-.07004***	.01826	-3.84	.0001	-.10583	-.03425
ASCD 3	.55696*	.31077	1.79	.0731	-.05214	1.16605
This is THETA(01) in class probability model.						
Constant	.22465*	.11901	1.89	.0591	-.00860	.45789
_JOBOT 1	-.52096	.41937	-1.24	.2141	-1.34290	.30098
This is THETA(02) in class probability model.						
Constant	.43587***	.12791	3.41	.0007	.18517	.68656
_JOBOT 2	-.50271	.41942	-1.20	.2307	-1.32477	.31934
This is THETA(03) in class probability model.						
Constant	0.0	.....(Fixed Parameter).....				
_JOBOT 3	0.0	.....(Fixed Parameter).....				

```
-----+-----
```

--

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.  
 Fixed parameter ... is constrained to equal the value or  
 had a nonpositive st.error because of an earlier problem.

```
-----+-----
```

```
--
```

```
|->
```

```
|-> Wald;
```

```
    Pts=1000;
```

```

Labels =
b1,    b2,    b3,    b4,    b5,    b6,    a1,
c1,    c2,    c3,    c4,    c5,    c6,    a2,
d1,    d2,    d3,    d4,    d5,    d6,    a3,
e1,e2,e3,e4,e5,e6;
Start  =      b;
Var    =      varb;
Fn1    =      b1/b6;
Fn2    =      b2/b6;
Fn3    =      b3/b6;
Fn4    =      b4/b6;
Fn5    =      b5/b6;
Fn6    =      c1/c6;
Fn7    =      c2/c6;
Fn8    =      c3/c6;
Fn9    =      c4/c6;
Fn10   =      c5/c6;
Fn11   =      d1/d6;
Fn12   =      d2/d6;
Fn13   =      d3/d6;
Fn14   =      d4/d6;
Fn15   =      d5/d6$;

```

```

-----
--
WALD procedure. Estimates and standard errors
for nonlinear functions and joint test of
nonlinear restrictions.

```

```

Wald Statistic          =      259.14427
Prob. from Chi-squared[15] =      .00000
Functions are computed at means of variables

```

```

-----
--

```

WaldFcns	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Fncn(1)	-11.1281***	1.02276	-10.88	.0000	-13.1327	-9.1235
Fncn(2)	-13.4979***	1.30373	-10.35	.0000	-16.0531	-10.9426
Fncn(3)	-14.3212***	1.35505	-10.57	.0000	-16.9771	-11.6654
Fncn(4)	-11.4831***	1.00081	-11.47	.0000	-13.4446	-9.5215
Fncn(5)	-11.3849***	1.03142	-11.04	.0000	-13.4064	-9.3633
Fncn(6)	1148.23	10202.15	.11	.9104	-18847.62	21144.07
Fncn(7)	6.91784	146.4939	.05	.9623	-280.20497	294.04066
Fncn(8)	-71.6261	563.0751	-.13	.8988	-1175.2331	1031.9809
Fncn(9)	-327.244	2805.616	-.12	.9071	-5826.150	5171.661
Fncn(10)	97.9126	939.4728	.10	.9170	-1743.4203	1939.2454
Fncn(11)	-24.3155***	4.73965	-5.13	.0000	-33.6051	-15.0260
Fncn(12)	.28605	2.75655	.10	.9174	-5.11669	5.68879
Fncn(13)	6.54228	4.24249	1.54	.1231	-1.77284	14.85741
Fncn(14)	16.5053**	6.79926	2.43	.0152	3.1790	29.8316
Fncn(15)	9.54924*	4.97948	1.92	.0551	-.21037	19.30884

```

-----
--

```

```

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
-----
--

```

```

|-> NLOGIT;
Lhs = choice, cset, alti;
Choices = a, b, c, d;

```

```

Model:
U(a)=  csta*ATTB_A          +          cstb*ATTB_B          +
       cstc*ATTB_C          +          cstd*ATTB_D          +
       cste*ATTB_E          +          cstf*cost/
U(b)=  csta*ATTB_A          +          cstb*ATTB_B          +
       cstc*ATTB_C          +          cstd*ATTB_D          +
       cste*ATTB_E          +          cstf*cost/
U(c)=  csta*ATTB_A          +          cstb*ATTB_B          +
       cstc*ATTB_C          +          cstd*ATTB_D          +
       cste*ATTB_E          +          cstf*cost/
U(d)=  ascd;
LCM=  JOBEMP;
parameters;
pts=3;
Pds   =          8$;
Normal exit:  5 iterations. Status=0, F=  6169.598

```

```

-----
--
Discrete choice (multinomial logit) model
Dependent variable      Choice
Log likelihood function  -6169.59788
Estimation based on N =  5168, K =  7
Inf.Cr.AIC = 12353.2 AIC/N =  2.390
Model estimated: Jul 02, 2020, 13:35:52
R2=1-LogL/LogL* Log-L fncn R-sqrd R2Adj
Constants only must be computed directly
          Use NLOGIT ;...;RHS=ONE$
Response data are given as ind. choices
Number of obs.=  5168, skipped  0 obs
-----

```

```

-----
--

```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
CSTA 1	1.50800***	.08136	18.53	.0000	1.34853	1.66747
CSTB 1	.41312***	.08194	5.04	.0000	.25252	.57371
CSTC 1	.27535***	.07945	3.47	.0005	.11963	.43107
CSTD 1	-.12704	.08524	-1.49	.1361	-.29410	.04002
CSTE 1	.25096***	.08053	3.12	.0018	.09312	.40881
CSTF 1	-.03814***	.00830	-4.59	.0000	-.05442	-.02187
ASCD 1	.36529***	.12958	2.82	.0048	.11132	.61925

```

-----

```

```

--
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
-----

```

```

--
Line search at iteration  54 does not improve fn. Exiting optimization.
-----

```

```

--
Latent Class Logit Model
Dependent variable      CHOICE
Log likelihood function  -5345.61557
Restricted log likelihood -7164.36926
Chi squared [ 25 d.f.]  3637.50738
Significance level      .00000
McFadden Pseudo R-squared .2538610
Estimation based on N =  5168, K =  25

```



```

Inf.Cr.AIC = 10741.2 AIC/N = 2.078
Model estimated: Jul 02, 2020, 13:35:59
Constants only must be computed directly
      Use NLOGIT ;...;RHS=ONE$
At start values -6169.6289 .1336*****
Response data are given as ind. choices
Number of latent classes = 3
Average Class Probabilities
      .306 .414 .280
LCM model with panel has 646 groups
Fixed number of obsrvs./group= 8
Number of obs.= 5168, skipped 0 obs

```

```

-----+-----
--

```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
-----+-----						
--						
Utility parameters in latent class -->> 1						
CSTA 1	.78284***	.15778	4.96	.0000	.47359	1.09209
CSTB 1	.96776***	.15919	6.08	.0000	.65576	1.27977
CSTC 1	1.04116***	.16660	6.25	.0000	.71464	1.36768
CSTD 1	.75632***	.17604	4.30	.0000	.41128	1.10135
CSTE 1	.82571***	.15757	5.24	.0000	.51689	1.13454
CSTF 1	-.06835***	.01662	-4.11	.0000	-.10092	-.03578
ASCD 1	-1.07527***	.31741	-3.39	.0007	-1.69739	-.45315
Utility parameters in latent class -->> 2						
CSTA 2	2.56505***	.21110	12.15	.0000	2.15130	2.97879
CSTB 2	-.06793	.20277	-.33	.7376	-.46534	.32949
CSTC 2	-.16279	.17839	-.91	.3615	-.51243	.18686
CSTD 2	-.72664***	.20321	-3.58	.0003	-1.12491	-.32836
CSTE 2	.11408	.18918	.60	.5465	-.25671	.48486
CSTF 2	.85063D-04	.02006	.00	.9966	-.39240D-01	.39410D-01
ASCD 2	-.65420*	.34386	-1.90	.0571	-1.32815	.01975
Utility parameters in latent class -->> 3						
CSTA 3	1.81511***	.19218	9.45	.0000	1.43846	2.19177
CSTB 3	.22356	.18570	1.20	.2286	-.14040	.58752
CSTC 3	-.32495*	.19259	-1.69	.0916	-.70242	.05253
CSTD 3	-1.09073***	.20272	-5.38	.0000	-1.48806	-.69340
CSTE 3	-.56089***	.19324	-2.90	.0037	-.93963	-.18214
CSTF 3	-.07656***	.01807	-4.24	.0000	-.11197	-.04115
ASCD 3	.84040***	.30205	2.78	.0054	.24839	1.43240
This is THETA(01) in class probability model.						
Constant	-.24245	.15954	-1.52	.1286	-.55515	.07025
_JOBEM 1	.75161***	.23438	3.21	.0013	.29224	1.21098
This is THETA(02) in class probability model.						
Constant	-.00646	.15749	-.04	.9673	-.31513	.30221
_JOBEM 2	.87045***	.22607	3.85	.0001	.42735	1.31354
This is THETA(03) in class probability model.						
Constant	0.0	.....(Fixed Parameter).....				
_JOBEM 3	0.0	.....(Fixed Parameter).....				
-----+-----						
--						

```

Note: nnnnn.D-xx or D+xx => multiply by 10 to -xx or +xx.
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
Fixed parameter ... is constrained to equal the value or
had a nonpositive st.error because of an earlier problem.

```

```

|->

```

```

|-> Wald;
  Pts=1000;
  Labels =
  b1,    b2,    b3,    b4,    b5,    b6,    a1,
  c1,    c2,    c3,    c4,    c5,    c6,    a2,
  d1,    d2,    d3,    d4,    d5,    d6,    a3,
  e1,e2,e3,e4,e5,e6;
  Start =      b;
  Var      =    varb;
  Fn1      =    b1/b6;
  Fn2      =    b2/b6;
  Fn3      =    b3/b6;
  Fn4      =    b4/b6;
  Fn5      =    b5/b6;
  Fn6      =    c1/c6;
  Fn7      =    c2/c6;
  Fn8      =    c3/c6;
  Fn9      =    c4/c6;
  Fn10     =    c5/c6;
  Fn11     =    d1/d6;
  Fn12     =    d2/d6;
  Fn13     =    d3/d6;
  Fn14     =    d4/d6;
  Fn15     =    d5/d6$;

```

-----  
 --  
 WALD procedure. Estimates and standard errors  
 for nonlinear functions and joint test of  
 nonlinear restrictions.

Wald Statistic = 211.78077  
 Prob. from Chi-squared[15] = .00000  
 Functions are computed at means of variables

```

-----+-----
--

```

	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Fncn(1)	-11.4538***	1.27523	-8.98	.0000	-13.9532	-8.9544
Fncn(2)	-14.1594***	1.65755	-8.54	.0000	-17.4082	-10.9107
Fncn(3)	-15.2333***	1.81152	-8.41	.0000	-18.7838	-11.6828
Fncn(4)	-11.0658***	1.17046	-9.45	.0000	-13.3598	-8.7717
Fncn(5)	-12.0811***	1.34922	-8.95	.0000	-14.7255	-9.4367
Fncn(6)	30154.7	.7116D+07	.00	.9966	-13916240.7	13976550.1
Fncn(7)	-798.535	186245.0	.00	.9966	-365832.001	364234.932
Fncn(8)	-1913.70	449601.0	.00	.9966	-883115.47	879288.06
Fncn(9)	-8542.34	.2013D+07	.00	.9966	-3953989.54	3936904.85
Fncn(10)	1341.12	318371.2	.00	.9966	-622654.92	625337.15
Fncn(11)	-23.7089***	4.17213	-5.68	.0000	-31.8861	-15.5316
Fncn(12)	-2.92012	1.94288	-1.50	.1328	-6.72809	.88784
Fncn(13)	4.24441	3.33774	1.27	.2035	-2.29744	10.78625
Fncn(14)	14.2470**	5.61396	2.54	.0112	3.2438	25.2502
Fncn(15)	7.32626*	4.02418	1.82	.0687	-.56099	15.21350

```

-----+-----
--

```

Note: nnnnn.D-xx or D+xx => multiply by 10 to -xx or +xx.  
 Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

```

|-> NLOGIT;
  Lhs      =          choice,      cset,      alti;
  Choices  =          a,          b,          c,          d;
  Model:
  U(a)=  csta*ATTB_A      +          cstab*ATTB_B      +
         cstc*ATTB_C      +          cstd*ATTB_D      +
         cste*ATTB_E      +          cstf*cost/
  U(b)=  csta*ATTB_A      +          cstab*ATTB_B      +
         cstc*ATTB_C      +          cstd*ATTB_D      +
         cste*ATTB_E      +          cstf*cost/
  U(c)=  csta*ATTB_A      +          cstab*ATTB_B      +
         cstc*ATTB_C      +          cstd*ATTB_D      +
         cste*ATTB_E      +          cstf*cost/
  U(d)=  ascd;
  LCM= SOC;
  parameters;
  pts=3;
  Pds      =          8$;
Normal exit:  5 iterations. Status=0, F=      6169.598

```

```

-----
--
Discrete choice (multinomial logit) model
Dependent variable      Choice
Log likelihood function -6169.59788
Estimation based on N = 5168, K = 7
Inf.Cr.AIC = 12353.2 AIC/N = 2.390
Model estimated: Jul 02, 2020, 13:36:00
R2=1-LogL/LogL* Log-L fncn R-sqrd R2Adj
Constants only must be computed directly
          Use NLOGIT ;...;RHS=ONE$
Response data are given as ind. choices
Number of obs.= 5168, skipped 0 obs
-----

```

```

-----
--

```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
CSTA 1	1.50800***	.08136	18.53	.0000	1.34853	1.66747
CSTB 1	.41312***	.08194	5.04	.0000	.25252	.57371
CSTC 1	.27535***	.07945	3.47	.0005	.11963	.43107
CSTD 1	-.12704	.08524	-1.49	.1361	-.29410	.04002
CSTE 1	.25096***	.08053	3.12	.0018	.09312	.40881
CSTF 1	-.03814***	.00830	-4.59	.0000	-.05442	-.02187
ASCD 1	.36529***	.12958	2.82	.0048	.11132	.61925

```

-----

```

```

--
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
-----

```

```

Line search at iteration 28 does not improve fn. Exiting optimization.
-----

```

```

--
Latent Class Logit Model
Dependent variable      CHOICE
Log likelihood function -5437.08230
Restricted log likelihood -7164.36926
Chi squared [ 25 d.f.] 3454.57392

```

Significance level .00000  
 McFadden Pseudo R-squared .2410941  
 Estimation based on N = 5168, K = 25  
 Inf.Cr.AIC = 10924.2 AIC/N = 2.114  
 Model estimated: Jul 02, 2020, 13:36:05  
 Constants only must be computed directly  
 Use NLOGIT ;...;RHS=ONE\$  
 At start values -6169.6289 .1187\*\*\*\*\*  
 Response data are given as ind. choices  
 Number of latent classes = 3  
 Average Class Probabilities  
 .469 .315 .217  
 LCM model with panel has 646 groups  
 Fixed number of obsrvs./group= 8  
 BHHH estimator used for asymp. variance  
 Number of obs.= 5168, skipped 0 obs

```

-----+-----
--

```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
-----+-----						
--						
Utility parameters in latent class -->> 1						
CSTA 1	.63016***	.14287	4.41	.0000	.35013	.91018
CSTB 1	.19112	.13491	1.42	.1566	-.07330	.45553
CSTC 1	.21291	.13259	1.61	.1083	-.04697	.47279
CSTD 1	-.13471	.14103	-.96	.3395	-.41113	.14171
CSTE 1	.12380	.13603	.91	.3628	-.14282	.39041
CSTF 1	-.00559	.01424	-.39	.6946	-.03349	.02231
ASCD 1	-2.49131***	.26912	-9.26	.0000	-3.01877	-1.96384
Utility parameters in latent class -->> 2						
CSTA 2	3.96483***	.29771	13.32	.0000	3.38133	4.54833
CSTB 2	.60100***	.22324	2.69	.0071	.16345	1.03855
CSTC 2	.23282	.19195	1.21	.2252	-.14341	.60904
CSTD 2	.16889	.20887	.81	.4188	-.24049	.57827
CSTE 2	.80127***	.22076	3.63	.0003	.36859	1.23396
CSTF 2	-.10234***	.02096	-4.88	.0000	-.14341	-.06126
ASCD 2	1.53788***	.38898	3.95	.0001	.77550	2.30026
Utility parameters in latent class -->> 3						
CSTA 3	2.14994***	.22787	9.44	.0000	1.70333	2.59656
CSTB 3	.87904***	.22996	3.82	.0001	.42833	1.32976
CSTC 3	.12787	.22660	.56	.5725	-.31625	.57199
CSTD 3	-.62906***	.23362	-2.69	.0071	-1.08695	-.17117
CSTE 3	.01569	.20795	.08	.9399	-.39189	.42327
CSTF 3	-.09213***	.02115	-4.36	.0000	-.13360	-.05067
ASCD 3	2.19829***	.36616	6.00	.0000	1.48063	2.91596
This is THETA(01) in class probability model.						
Constant	.84365***	.18525	4.55	.0000	.48055	1.20674
_SOC 1	-.11203	.21678	-.52	.6053	-.53690	.31285
This is THETA(02) in class probability model.						
Constant	.54235***	.19201	2.82	.0047	.16603	.91868
_SOC 2	-.26691	.21679	-1.23	.2182	-.69180	.15798
This is THETA(03) in class probability model.						
Constant	0.0	.....(Fixed Parameter).....				
_SOC 3	0.0	.....(Fixed Parameter).....				
-----+-----						
--						

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.  
 Fixed parameter ... is constrained to equal the value or  
 had a nonpositive st.error because of an earlier problem.

```

-----
--
|->
|-> Wald;
    Pts=1000;
    Labels =
    b1,    b2,    b3,    b4,    b5,    b6,    a1,
    c1,    c2,    c3,    c4,    c5,    c6,    a2,
    d1,    d2,    d3,    d4,    d5,    d6,    a3,
    e1,e2,e3,e4,e5,e6;
    Start = b;
    Var = varb;
    Fn1 = b1/b6;
    Fn2 = b2/b6;
    Fn3 = b3/b6;
    Fn4 = b4/b6;
    Fn5 = b5/b6;
    Fn6 = c1/c6;
    Fn7 = c2/c6;
    Fn8 = c3/c6;
    Fn9 = c4/c6;
    Fn10 = c5/c6;
    Fn11 = d1/d6;
    Fn12 = d2/d6;
    Fn13 = d3/d6;
    Fn14 = d4/d6;
    Fn15 = d5/d6$;

```

-----
--
WALD procedure. Estimates and standard errors
for nonlinear functions and joint test of
nonlinear restrictions.

Wald Statistic = 678.71916
Prob. from Chi-squared[15] = .00000
Functions are computed at means of variables

```

-----+-----
--

```

WaldFncs	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Fncn(1)	-112.732	263.4261	-.43	.6687	-629.037	403.574
Fncn(2)	-34.1898	64.28681	-.53	.5948	-160.1896	91.8101
Fncn(3)	-38.0879	74.98176	-.51	.6115	-185.0494	108.8737
Fncn(4)	24.0984	85.73418	.28	.7786	-143.9375	192.1343
Fncn(5)	-22.1464	33.68959	-.66	.5109	-88.1768	43.8839
Fncn(6)	-38.7431***	6.05437	-6.40	.0000	-50.6095	-26.8768
Fncn(7)	-5.87280***	1.22955	-4.78	.0000	-8.28267	-3.46292
Fncn(8)	-2.27503	1.49968	-1.52	.1293	-5.21436	.66430
Fncn(9)	-1.65032	1.74776	-.94	.3450	-5.07586	1.77522
Fncn(10)	-7.82980***	.87745	-8.92	.0000	-9.54957	-6.11002
Fncn(11)	-23.3349***	3.78124	-6.17	.0000	-30.7460	-15.9238
Fncn(12)	-9.54090***	1.22338	-7.80	.0000	-11.93867	-7.14312
Fncn(13)	-1.38785	2.19600	-.63	.5274	-5.69193	2.91623
Fncn(14)	6.82762*	3.90283	1.75	.0802	-.82178	14.47702
Fncn(15)	-.17028	2.22276	-.08	.9389	-4.52681	4.18626

```

-----+-----
--

```

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

## 10.2 3 class with WTP for socio econ groups positive/negative without K & R (Delta method).

### 10.2.1 Positive in class 1, 3 class lcm plus WTP including extracted socio econ group results

This is THETA(01) in class probability model.						
Constant	.04246	.12517	.34	.7345	-.20288	.28779
_AGE25 1	.84134**	.40691	2.07	.0387	.04381	1.63887
This is THETA(01) in class probability model.						
Constant	.00095	.12592	.01	.9940	-.24584	.24774
_LIVEO 1	.81266**	.33720	2.41	.0160	.15176	1.47356
This is THETA(01) in class probability model.						
Constant	-.17732	.14075	-1.26	.2077	-.45319	.09855
_GENMR 1	.94368***	.26312	3.59	.0003	.42799	1.45938
This is THETA(01) in class probability model.						
Constant	-.35297**	.15311	-2.31	.0212	-.65306	-.05287
_PROF 1	1.24578***	.24724	5.04	.0000	.76120	1.73037
This is THETA(01) in class probability model.						
Constant	-.24245	.15954	-1.52	.1286	-.55515	.07025
_JOBEM 1	.75161***	.23438	3.21	.0013	.29224	1.21098

### 10.2.2 Positive in class 1, 3 class lcm plus WTP including socio econ groups AGE2534 LIVEOTH GENMR PROF JOBEMP – code and output

```
|-> NLOGIT;
  Lhs      =          choice,      cset,      alti;
  Choices  =          a,          b,          c,          d;
  Model:
  U(a)=  csta*ATTB_A          +          cstab*ATTB_B          +
         cstc*ATTB_C          +          cstd*ATTB_D          +
         cste*ATTB_E          +          cstf*cost/
  U(b)=  csta*ATTB_A          +          cstab*ATTB_B          +
         cstc*ATTB_C          +          cstd*ATTB_D          +
         cste*ATTB_E          +          cstf*cost/
  U(c)=  csta*ATTB_A          +          cstab*ATTB_B          +
         cstc*ATTB_C          +          cstd*ATTB_D          +
         cste*ATTB_E          +          cstf*cost/
  U(d)=  ascd;
  LCM= AGE2534, LIVEOTH, GENMR, PROF, JOBEMP;
  parameters;
  pts=3;
  Pds      =          8$;
Normal exit:   5 iterations. Status=0, F=          6169.598
```

```
-----
--
Discrete choice (multinomial logit) model
Dependent variable          Choice
Log likelihood function      -6169.59788
Estimation based on N =     5168, K =    7
Inf.Cr.AIC = 12353.2 AIC/N =    2.390
Model estimated: Jul 14, 2020, 12:51:06
R2=1-LogL/LogL* Log-L fncn R-sqrd R2Adj
Constants only must be computed directly
          Use NLOGIT ;...;RHS=ONE$
Response data are given as ind. choices
```

Number of obs.= 5168, skipped 0 obs

```
-----+-----
--
|
CHOICE| Coefficient      Standard      Prob.      95% Confidence
      |      Error        z      |z|>Z*      Interval
-----+-----
--
CSTA|1|  1.50800***    .08136     18.53    .0000      1.34853    1.66747
CSTB|1|  .41312***     .08194      5.04    .0000      .25252     .57371
CSTC|1|  .27535***     .07945      3.47    .0005      .11963     .43107
CSTD|1|  -.12704        .08524     -1.49    .1361     -.29410    .04002
CSTE|1|  .25096***     .08053      3.12    .0018      .09312     .40881
CSTF|1|  -.03814***     .00830     -4.59    .0000     -.05442    -.02187
ASCD|1|  .36529***     .12958      2.82    .0048      .11132     .61925
-----+-----
```

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

Line search at iteration 63 does not improve fn. Exiting optimization.

```
-----+-----
--
Latent Class Logit Model
Dependent variable      CHOICE
Log likelihood function -5326.77669
Restricted log likelihood -7164.36926
Chi squared [ 33 d.f.]  3675.18514
Significance level      .00000
McFadden Pseudo R-squared .2564905
Estimation based on N = 5168, K = 33
Inf.Cr.AIC = 10719.6 AIC/N = 2.074
Model estimated: Jul 14, 2020, 12:51:14
Constants only must be computed directly
      Use NLOGIT ;...;RHS=ONE$
At start values -6169.6289 .1366*****
Response data are given as ind. choices
Number of latent classes = 3
Average Class Probabilities
      .309 .412 .279
LCM model with panel has 646 groups
Fixed number of obsrvs./group= 8
Number of obs.= 5168, skipped 0 obs
-----+-----
```

```
-----+-----
--
|
CHOICE| Coefficient      Standard      Prob.      95% Confidence
      |      Error        z      |z|>Z*      Interval
-----+-----
--
      |Utility parameters in latent class -->> 1
CSTA|1|  .78960***    .15936      4.95    .0000      .47725     1.10195
CSTB|1|  .95712***    .16255      5.89    .0000      .63853     1.27572
CSTC|1|  1.03998***   .16519      6.30    .0000      .71620     1.36375
CSTD|1|  .74808***    .17438      4.29    .0000      .40629     1.08987
CSTE|1|  .82901***    .15690      5.28    .0000      .52149     1.13652
CSTF|1|  -.06741***    .01671     -4.03    .0001     -.10016    -.03465
ASCD|1| -1.07562***   .31800     -3.38    .0007     -1.69889   -.45235
      |Utility parameters in latent class -->> 2
CSTA|2|  2.58256***   .21808     11.84   .0000      2.15512    3.00999
CSTB|2|  -.06212      .20640     -.30    .7634     -.46665    .34242
-----+-----
```

```

CSTC|2|    -.17105      .18090      -.95   .3444      -.52560      .18350
CSTD|2|    -.72514***    .20803     -3.49  .0005     -1.13287     -.31742
CSTE|2|     .10750      .19183       .56   .5752      -.26849      .48348
CSTF|2|    -.00057      .02038      -.03   .9775      -.04051      .03937
ASCD|2|    -.62384*      .35490     -1.76  .0788     -1.31943      .07174
|Utility parameters in latent class -->> 3
CSTA|3|    1.80720***    .19298       9.36  .0000      1.42896      2.18544
CSTB|3|     .22756      .18800       1.21  .2261     -.14091      .59602
CSTC|3|    -.33774*      .19555     -1.73  .0841     -.72101      .04553
CSTD|3|   -1.09684***    .20451     -5.36  .0000     -1.49767     -.69600
CSTE|3|    -.57373***    .19497     -2.94  .0033     -.95586     -.19160
CSTF|3|    -.07585***    .01836     -4.13  .0000     -.11183     -.03987
ASCD|3|     .83441***    .30613       2.73  .0064      .23441      1.43440
|This is THETA(01) in class probability model.
Constant|   -.77399***    .19354     -4.00  .0001     -1.15332     -.39465
 _AGE25|1|   .25308      .43474       .58   .5605     -.59900      1.10517
 _LIVEO|1|   .54885      .34797       1.58  .1147     -.13316      1.23086
 _GENMR|1|   .61399**     .28135       2.18  .0291      .06256      1.16543
 _PROF|1|   .99261***    .26223       3.79  .0002      .47865      1.50657
 _JOBEM|1|   .48017*      .24519       1.96  .0502     -.00039      .96074
|This is THETA(02) in class probability model.
Constant|   -.15256      .17398      -.88   .3805     -.49356      .18843
 _AGE25|2|  -.06842      .46240     -.15   .8824     -.97472      .83788
 _LIVEO|2|   .47206      .34630       1.36  .1728     -.20668      1.15079
 _GENMR|2|   .19682      .27261       .72   .4703     -.33748      .73113
 _PROF|2|   .28306      .25242       1.12  .2621     -.21168      .77781
 _JOBEM|2|   .78174***    .23210       3.37  .0008     .32682      1.23665
|This is THETA(03) in class probability model.
Constant|    0.0      .....(Fixed Parameter).....
 _AGE25|3|    0.0      .....(Fixed Parameter).....
 _LIVEO|3|    0.0      .....(Fixed Parameter).....
 _GENMR|3|    0.0      .....(Fixed Parameter).....
 _PROF|3|    0.0      .....(Fixed Parameter).....
 _JOBEM|3|    0.0      .....(Fixed Parameter).....
-----+-----
--

```

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.  
Fixed parameter ... is constrained to equal the value or  
had a nonpositive st.error because of an earlier problem.

--

```

|->
|-> Wald;
    Pts=1000;
    Labels =
    b1,    b2,    b3,    b4,    b5,    b6,    a1,
    c1,    c2,    c3,    c4,    c5,    c6,    a2,
    d1,    d2,    d3,    d4,    d5,    d6,    a3,
    e1,e2,e3,e4,e5,e6,e7,e8,e9,e10,e11,e12,e13,e14,e15,e16,e17,e18;
    Start =          b;
    Var    =          varb;
    Fn1    =          b1/b6;
    Fn2    =          b2/b6;
    Fn3    =          b3/b6;
    Fn4    =          b4/b6;
    Fn5    =          b5/b6;
    Fn6    =          c1/c6;
    Fn7    =          c2/c6;
    Fn8    =          c3/c6;
    Fn9    =          c4/c6;

```



```

Fn10 = c5/c6;
Fn11 = d1/d6;
Fn12 = d2/d6;
Fn13 = d3/d6;
Fn14 = d4/d6;
Fn15 = d5/d6$;

```

```

-----
--
WALD procedure. Estimates and standard errors
for nonlinear functions and joint test of
nonlinear restrictions.
Wald Statistic = 197.45761
Prob. from Chi-squared[15] = .00000
Functions are computed at means of variables
-----+-----
--

```

WaldFcns	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Fncn(1)	-11.7142***	1.33865	-8.75	.0000	-14.3379	-9.0905
Fncn(2)	-14.1994***	1.69098	-8.40	.0000	-17.5137	-10.8852
Fncn(3)	-15.4286***	1.93425	-7.98	.0000	-19.2197	-11.6376
Fncn(4)	-11.0982***	1.23257	-9.00	.0000	-13.5140	-8.6824
Fncn(5)	-12.2988***	1.46225	-8.41	.0000	-15.1648	-9.4328
Fncn(6)	-4496.27	159230.4	-.03	.9775	-316582.15	307589.60
Fncn(7)	108.152	4161.792	.03	.9793	-8048.812	8265.115
Fncn(8)	297.800	10843.47	.03	.9781	-20955.002	21550.601
Fncn(9)	1262.49	45116.23	.03	.9777	-87163.70	89688.68
Fncn(10)	-187.152	6343.905	-.03	.9765	-12620.978	12246.673
Fncn(11)	-23.8260***	4.38130	-5.44	.0000	-32.4132	-15.2388
Fncn(12)	-3.00009	1.98759	-1.51	.1312	-6.89569	.89550
Fncn(13)	4.45274	3.46586	1.28	.1989	-2.34022	11.24569
Fncn(14)	14.4606**	5.78320	2.50	.0124	3.1258	25.7955
Fncn(15)	7.56403*	4.15329	1.82	.0686	-.57628	15.70433

```

-----+-----
--
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
-----
--

```

### 10.2.3 Negative in class 1, 3 class lcn plus WTP including extracted socio econ group results

```

|This is THETA(01) in class probability model.
Constant| .24993* .13294 1.88 .0601 -.01063 .51048
_AGE55|1| -.53005** .26918 -1.97 .0489 -1.05764 -.00246
This is THETA(01) in class probability model.
Constant| .19105 .12077 1.58 .1137 -.04566 .42775
_LIVEW|1| -1.29943** .53422 -2.43 .0150 -2.34648 -.25239
|This is THETA(01) in class probability model.
Constant| .16994 .11982 1.42 .1561 -.06491 .40478
_GENPN|1| -1.58630** .75431 -2.10 .0355 -3.06473 -.10788
|This is THETA(01) in class probability model.
Constant| .40208** .18156 2.21 .0268 .04623 .75793
_GENMS|1| -.54656** .25379 -2.15 .0313 -1.04397 -.04914
|This is THETA(01) in class probability model.
Constant| -.13802 .19274 -.72 .4739 -.51578 .23974

```

```

_EDUUN|1| -1.68997*** .22498 -7.51 .0000 -2.13091 -1.24902
          |This is THETA(01) in class probability model.
Constant| .00226 .12318 .02 .9854 -.23917 .24369
_JOBBL|1| -1.66992*** .37390 -4.47 .0000 -2.40275 -.93709
          |This is THETA(01) in class probability model.
Constant| 1.46784*** .15610 9.40 .0000 1.16189 1.77379
_JOBRE|1| -.99511*** .27212 -3.66 .0003 -1.52846 -.46175

```

#### 10.2.4 Negative in class 1, 3 class lcn plus WTP including socio econ AGE5564, LIVEWEN, GENPNTS, GENMS, JOBUNEM, JOBBLANK, JOBRET – code and output

```

|-> NLOGIT;
Lhs = choice, cset, alti;
Choices = a, b, c, d;
Model:
U(a)= csta*ATTB_A + cstb*ATTB_B +
      cstc*ATTB_C + cstd*ATTB_D +
      cste*ATTB_E + cstf*cost/
U(b)= csta*ATTB_A + cstb*ATTB_B +
      cstc*ATTB_C + cstd*ATTB_D +
      cste*ATTB_E + cstf*cost/
U(c)= csta*ATTB_A + cstb*ATTB_B +
      cstc*ATTB_C + cstd*ATTB_D +
      cste*ATTB_E + cstf*cost/
U(d)= ascd;
LCM= AGE5564, LIVEWEN, GENPNTS, GENMS, JOBUNEM, JOBBLANK, JOBRET;
parameters;
pts=3;
Pds = 8$;
Normal exit: 5 iterations. Status=0, F= 6169.598

```

```

-----
--
Discrete choice (multinomial logit) model
Dependent variable      Choice
Log likelihood function -6169.59788
Estimation based on N = 5168, K = 7
Inf.Cr.AIC = 12353.2 AIC/N = 2.390
Model estimated: Jul 14, 2020, 12:44:25
R2=1-LogL/LogL* Log-L fncn R-sqrd R2Adj
Constants only must be computed directly
      Use NLOGIT ;...;RHS=ONE$
Response data are given as ind. choices
Number of obs.= 5168, skipped 0 obs
-----

```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
CSTA 1	1.50800***	.08136	18.53	.0000	1.34853	1.66747
CSTB 1	.41312***	.08194	5.04	.0000	.25252	.57371
CSTC 1	.27535***	.07945	3.47	.0005	.11963	.43107
CSTD 1	-.12704	.08524	-1.49	.1361	-.29410	.04002
CSTE 1	.25096***	.08053	3.12	.0018	.09312	.40881
CSTF 1	-.03814***	.00830	-4.59	.0000	-.05442	-.02187
ASCD 1	.36529***	.12958	2.82	.0048	.11132	.61925

```

-----+-----
--
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
-----+-----
--

```

Line search at iteration 37 does not improve fn. Exiting optimization.

```

-----+-----
--
Latent Class Logit Model
Dependent variable          CHOICE
Log likelihood function     -5432.86661
Restricted log likelihood   -7164.36926
Chi squared [ 37 d.f.]     3463.00530
Significance level         .00000
McFadden Pseudo R-squared .2416825
Estimation based on N =   5168, K = 37
Inf.Cr.AIC = 10939.7 AIC/N = 2.117
Model estimated: Jul 14, 2020, 12:44:34
Constants only must be computed directly
                        Use NLOGIT ;...;RHS=ONE$
At start values -6169.6289 .1194*****
Response data are given as ind. choices
Number of latent classes = 3
Average Class Probabilities
                        .259 .509 .232
LCM model with panel has 646 groups
Fixed number of obsrvs./group= 8
BHHH estimator used for asymp. variance
Number of obs.= 5168, skipped 0 obs
-----+-----
--

```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
-----+-----						
Utility parameters in latent class --> 1						
CSTA 1	.94389***	.17608	5.36	.0000	.59878	1.28900
CSTB 1	1.33907***	.17133	7.82	.0000	1.00327	1.67486
CSTC 1	1.28261***	.17324	7.40	.0000	.94306	1.62215
CSTD 1	.98189***	.18302	5.37	.0000	.62319	1.34060
CSTE 1	1.19927***	.16925	7.09	.0000	.86754	1.53100
CSTF 1	-.10809***	.01834	-5.89	.0000	-.14403	-.07215
ASCD 1	-2.14182***	.32660	-6.56	.0000	-2.78195	-1.50169
Utility parameters in latent class --> 2						
CSTA 2	2.64406***	.16567	15.96	.0000	2.31935	2.96876
CSTB 2	-.25232	.16526	-1.53	.1268	-.57623	.07159
CSTC 2	-.24431	.14928	-1.64	.1017	-.53689	.04827
CSTD 2	-.75377***	.16232	-4.64	.0000	-1.07191	-.43564
CSTE 2	.14582	.16071	.91	.3642	-.16917	.46081
CSTF 2	-.00113	.01580	-.07	.9431	-.03211	.02985
ASCD 2	-.10518	.25778	-.41	.6833	-.61042	.40006
Utility parameters in latent class --> 3						
CSTA 3	1.67119***	.21907	7.63	.0000	1.24181	2.10056
CSTB 3	.90243***	.22309	4.05	.0001	.46519	1.33968
CSTC 3	.11002	.21350	.52	.6063	-.30842	.52847
CSTD 3	-1.34523***	.22810	-5.90	.0000	-1.79231	-.89816
CSTE 3	-.45311**	.20221	-2.24	.0250	-.84944	-.05678
CSTF 3	-.06444***	.02037	-3.16	.0016	-.10437	-.02452
ASCD 3	1.73981***	.35129	4.95	.0000	1.05129	2.42833

```

      |This is THETA(01) in class probability model.
Constant|    1.15641***    .23078    5.01 .0000    .70408    1.60873
 _AGE55|1|   -1.65059***    .27961   -5.90 .0000   -2.19861  -1.10257
 _LIVEW|1|   -2.39840***    .54358   -4.41 .0000   -3.46381  -1.33300
 _GENPN|1|   -4.67649***    .79912   -5.85 .0000   -6.24273  -3.11026
 _GENMS|1|    -.04921    .27058    -.18 .8557    -.57953    .48111
 _JOBUN|1|   -2.07393***    .67143   -3.09 .0020   -3.38991  -.75794
 _JOBBL|1|   -1.75527***    .41846   -4.19 .0000   -2.57542  -.93511
 _JOBRE|1|    -.77556**    .31021   -2.50 .0124   -1.38356  -.16756

```

```

      |This is THETA(02) in class probability model.
Constant|    1.41619***    .22400    6.32 .0000    .97716    1.85522
 _AGE55|2|   -1.37713***    .25481   -5.40 .0000   -1.87654  -.87772
 _LIVEW|2|   -1.61503***    .39326   -4.11 .0000   -2.38581  -.84426
 _GENPN|2|   -1.10228**    .50712   -2.17 .0297   -2.09622  -.10834
 _GENMS|2|    .29188    .25623    1.14 .2547    -.21033    .79409
 _JOBUN|2|   -.31677    .67160    -.47 .6372   -1.63308    .99955
 _JOBBL|2|   -1.52115***    .47093   -3.23 .0012   -2.44415  -.59815
 _JOBRE|2|   -.21226    .26592    -.80 .4247    -.73346    .30893

```

```

      |This is THETA(03) in class probability model.

```

```

Constant|    0.0    .....(Fixed Parameter).....
 _AGE55|3|    0.0    .....(Fixed Parameter).....
 _LIVEW|3|    0.0    .....(Fixed Parameter).....
 _GENPN|3|    0.0    .....(Fixed Parameter).....
 _GENMS|3|    0.0    .....(Fixed Parameter).....
 _JOBUN|3|    0.0    .....(Fixed Parameter).....
 _JOBBL|3|    0.0    .....(Fixed Parameter).....
 _JOBRE|3|    0.0    .....(Fixed Parameter).....

```

```

-----+-----
--

```

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.  
Fixed parameter ... is constrained to equal the value or  
had a nonpositive st.error because of an earlier problem.

```

-----+-----
--

```

```

|->
|-> Wald;
    Pts=1000;
    Labels =
    b1,    b2,    b3,    b4,    b5,    b6,    a1,
    c1,    c2,    c3,    c4,    c5,    c6,    a2,
    d1,    d2,    d3,    d4,    d5,    d6,    a3,

```

```

e1,e2,e3,e4,e5,e6,e7,e8,e9,e10,e11,e12,e13,e14,e15,e16,e17,e18,e19,e20,e21,
e22,e23,e24;

```

```

    Start =    b;
    Var =    varb;
    Fn1 =    b1/b6;
    Fn2 =    b2/b6;
    Fn3 =    b3/b6;
    Fn4 =    b4/b6;
    Fn5 =    b5/b6;
    Fn6 =    c1/c6;
    Fn7 =    c2/c6;
    Fn8 =    c3/c6;
    Fn9 =    c4/c6;
    Fn10 =    c5/c6;
    Fn11 =    d1/d6;
    Fn12 =    d2/d6;
    Fn13 =    d3/d6;
    Fn14 =    d4/d6;

```

Fn15 = d5/d6\$;

```

-----
--
WALD procedure. Estimates and standard errors
for nonlinear functions and joint test of
nonlinear restrictions.
Wald Statistic = 856.61928
Prob. from Chi-squared[15] = .00000
Functions are computed at means of variables
-----+-----
--

```

WaldFcns	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Fncn(1)	-8.73232***	.62502	-13.97	.0000	-9.95734	-7.50730
Fncn(2)	-12.3882***	.70793	-17.50	.0000	-13.7758	-11.0007
Fncn(3)	-11.8659***	.69175	-17.15	.0000	-13.2217	-10.5101
Fncn(4)	-9.08388***	.51224	-17.73	.0000	-10.08786	-8.07990
Fncn(5)	-11.0950***	.56084	-19.78	.0000	-12.1942	-9.9957
Fncn(6)	-2343.02	32691.89	-.07	.9429	-66417.95	61731.91
Fncn(7)	223.592	3265.942	.07	.9454	-6177.536	6624.720
Fncn(8)	216.494	3150.984	.07	.9452	-5959.321	6392.310
Fncn(9)	667.953	9486.532	.07	.9439	-17925.308	19261.214
Fncn(10)	-129.221	1676.781	-.08	.9386	-3415.651	3157.208
Fncn(11)	-25.9326***	5.85085	-4.43	.0000	-37.4001	-14.4652
Fncn(12)	-14.0035***	2.19233	-6.39	.0000	-18.3004	-9.7066
Fncn(13)	-1.70730	2.87959	-.59	.5533	-7.35120	3.93660
Fncn(14)	20.8747**	9.60732	2.17	.0298	2.0447	39.7047
Fncn(15)	7.03113	5.18630	1.36	.1752	-3.13383	17.19608

```

-----+-----
--
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
-----
--

```

### 10.2.5 Positive in class 2, 3 class lcm plus WTP including extracted socio econ group results

	This is THETA(02) in class probability model.					
Constant	.27881**	.13230	2.11	.0351	.01950	.53812
_AGE35 2	.69842**	.29245	2.39	.0169	.12523	1.27161
	This is THETA(02) in class probability model.					
Constant	.32481***	.12290	2.64	.0082	.08394	.56569
_LIVEO 2	.67550**	.33814	2.00	.0458	.01276	1.33825
	This is THETA(02) in class probability model.					
Constant	.35593***	.12168	2.93	.0034	.11745	.59442
_LIVES 2	.70435*	.42335	1.66	.0962	-.12540	1.53410
	This is THETA(02) in class probability model.					
Constant	.28610**	.12992	2.20	.0277	.03146	.54075
_GENMR 2	.44286*	.25984	1.70	.0883	-.06642	.95215
	This is THETA(02) in class probability model.					
Constant	.27468**	.13343	2.06	.0395	.01315	.53620
_PROF 2	.47189**	.23997	1.97	.0492	.00156	.94221
	This is THETA(02) in class probability model.					

```

Constant|      -.00646      .15749      -.04   .9673      -.31513      .30221
_JOBEM|2|      .87045***    .22607      3.85   .0001      .42735      1.31354

```

```

AGE3544
LIVEOTH
LIVESWEN
GENMR
PROF
JOBEMP

```

10.2.6 Positive in class 2, 3 class lcm plus WTP including socio econ groups AGE3544, LIVEOTH, LIVESWEN, GENMR,PROF, JOBEMP – code and output

```

|-> NLOGIT;
  Lhs      =      choice,      cset,      alti;
  Choices      =      a,      b,      c,      d;
  Model:
  U(a)=  csta*ATTB_A      +      cstb*ATTB_B      +
         cstc*ATTB_C      +      cstd*ATTB_D      +
         cste*ATTB_E      +      cstf*cost/
  U(b)=  csta*ATTB_A      +      cstb*ATTB_B      +
         cstc*ATTB_C      +      cstd*ATTB_D      +
         cste*ATTB_E      +      cstf*cost/
  U(c)=  csta*ATTB_A      +      cstb*ATTB_B      +
         cstc*ATTB_C      +      cstd*ATTB_D      +
         cste*ATTB_E      +      cstf*cost/
  U(d)=  ascd;
  LCM= AGE3544, LIVEOTH, LIVESWEN, GENMR,PROF, JOBEMP;
  parameters;
  pts=3;
  Pds      =      8$;
Normal exit:  5 iterations. Status=0, F=      6169.598

```

```

-----
--
Discrete choice (multinomial logit) model
Dependent variable      Choice
Log likelihood function      -6169.59788
Estimation based on N =      5168, K =      7
Inf.Cr.AIC = 12353.2 AIC/N =      2.390
Model estimated: Jul 14, 2020, 13:04:48
R2=1-LogL/LogL* Log-L fncn R-sqrd R2Adj
Constants only must be computed directly
      Use NLOGIT ;...;RHS=ONE$
Response data are given as ind. choices
Number of obs.= 5168, skipped      0 obs
-----

```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
CSTA 1	1.50800***	.08136	18.53	.0000	1.34853	1.66747
CSTB 1	.41312***	.08194	5.04	.0000	.25252	.57371
CSTC 1	.27535***	.07945	3.47	.0005	.11963	.43107
CSTD 1	-.12704	.08524	-1.49	.1361	-.29410	.04002
CSTE 1	.25096***	.08053	3.12	.0018	.09312	.40881

```

CSTF|1|    -.03814***    .00830    -4.59    .0000    -.05442    -.02187
ASCD|1|    .36529***    .12958    2.82    .0048    .11132    .61925

```

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

Normal exit: 64 iterations. Status=0, F= 5323.215

```

Latent Class Logit Model
Dependent variable          CHOICE
Log likelihood function     -5323.21515
Restricted log likelihood   -7164.36926
Chi squared [ 35 d.f.]     3682.30822
Significance level         .00000
McFadden Pseudo R-squared  .2569876
Estimation based on N =   5168, K = 35
Inf.Cr.AIC = 10716.4 AIC/N = 2.074
Model estimated: Jul 14, 2020, 13:04:54
Constants only must be computed directly
                        Use NLOGIT ;...;RHS=ONE$
At start values -6169.6289 .1372*****
Response data are given as ind. choices
Number of latent classes = 3
Average Class Probabilities
    .308 .414 .278
LCM model with panel has 646 groups
Fixed number of obsrvs./group= 8
Number of obs.= 5168, skipped 0 obs

```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval
--------	-------------	----------------	---	--------------	-------------------------

```

|Utility parameters in latent class -->> 1
CSTA|1|    .78910***    .15959    4.94    .0000    .47631    1.10190
CSTB|1|    .96196***    .16369    5.88    .0000    .64114    1.28278
CSTC|1|    1.04450***    .16468    6.34    .0000    .72174    1.36726
CSTD|1|    .75358***    .17316    4.35    .0000    .41420    1.09296
CSTE|1|    .83123***    .15709    5.29    .0000    .52334    1.13912
CSTF|1|    -.06741***    .01667    -4.04    .0001    -.10007    -.03474
ASCD|1|    -1.06806***    .31777    -3.36    .0008    -1.69088    -.44524

```

```

|Utility parameters in latent class -->> 2
CSTA|2|    2.58117***    .21015    12.28    .0000    2.16928    2.99306
CSTB|2|    -.05503    .20513    -.27    .7885    -.45708    .34702
CSTC|2|    -.16268    .17984    -.90    .3657    -.51516    .18980
CSTD|2|    -.71692***    .20399    -3.51    .0004    -1.11674    -.31710
CSTE|2|    .11326    .19013    .60    .5514    -.25938    .48591
CSTF|2|    -.00191    .02032    -.09    .9252    -.04173    .03791
ASCD|2|    -.62235*    .34440    -1.81    .0708    -1.29735    .05266

```

```

|Utility parameters in latent class -->> 3
CSTA|3|    1.79742***    .19396    9.27    .0000    1.41726    2.17758
CSTB|3|    .22389    .19021    1.18    .2392    -.14892    .59669
CSTC|3|    -.34154*    .19655    -1.74    .0823    -.72678    .04369
CSTD|3|    -1.10147***    .20608    -5.34    .0000    -1.50538    -.69757
CSTE|3|    -.56880***    .19565    -2.91    .0036    -.95228    -.18533
CSTF|3|    -.07584***    .01820    -4.17    .0000    -.11151    -.04017

```

```

ASCD|3|      .82653***      .30542      2.71  .0068      .22792      1.42515
|This is THETA(01) in class probability model.
Constant|    -.83731***      .20141      -4.16 .0000      -1.23206     -.44256
_LIVEO|1|     .06485      .32187      .20  .8403      -.56600      .69570
_LIVEO|1|     .63130*      .34966      1.81 .0710      -.05402      1.31662
_LIVES|1|     .71800      .45134      1.59 .1117      -.16662      1.60261
_GENMR|1|     .57538**      .28352      2.03 .0424      .01969      1.13108
_PROF|1|      1.01593***      .26065      3.90 .0001      .50507      1.52679
_JOBEM|1|     .50374**      .24827      2.03 .0425      .01713      .99035
|This is THETA(02) in class probability model.
Constant|    -.26899      .18106      -1.49 .1374      -.62386      .08589
_AGE35|2|     .43729      .30358      1.44 .1497      -.15771      1.03230
_LIVEO|2|     .57245*      .34620      1.65 .0982      -.10609      1.25099
_LIVES|2|     .85410**      .42896      1.99 .0465      .01335      1.69484
_GENMR|2|     .13888      .27531      .50  .6139      -.40073      .67849
_PROF|2|     .23101      .25233      .92  .3599      -.26355      .72557
_JOBEM|2|     .72170***      .23627      3.05 .0023      .25862      1.18479
|This is THETA(03) in class probability model.
Constant|      0.0      .....(Fixed Parameter).....
_AGE35|3|      0.0      .....(Fixed Parameter).....
_LIVEO|3|      0.0      .....(Fixed Parameter).....
_LIVES|3|      0.0      .....(Fixed Parameter).....
_GENMR|3|      0.0      .....(Fixed Parameter).....
_PROF|3|      0.0      .....(Fixed Parameter).....
_JOBEM|3|      0.0      .....(Fixed Parameter).....
-----+-----

```

```

--
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
Fixed parameter ... is constrained to equal the value or
had a nonpositive st.error because of an earlier problem.
-----
--

```

```

|->
|-> Wald;
    Pts=1000;
    Labels =
    b1,    b2,    b3,    b4,    b5,    b6,    a1,
    c1,    c2,    c3,    c4,    c5,    c6,    a2,
    d1,    d2,    d3,    d4,    d5,    d6,    a3,

e1,e2,e3,e4,e5,e6,e7,e8,e9,e10,e11,e12,e13,e14,e15,e16,e17,e18,e19,e20,e21;
    Start =      b;
    Var =      varb;
    Fn1 =      b1/b6;
    Fn2 =      b2/b6;
    Fn3 =      b3/b6;
    Fn4 =      b4/b6;
    Fn5 =      b5/b6;
    Fn6 =      c1/c6;
    Fn7 =      c2/c6;
    Fn8 =      c3/c6;
    Fn9 =      c4/c6;
    Fn10 =     c5/c6;
    Fn11 =     d1/d6;
    Fn12 =     d2/d6;
    Fn13 =     d3/d6;
    Fn14 =     d4/d6;
    Fn15 =     d5/d6$;

```



```

-----
--
WALD procedure. Estimates and standard errors
for nonlinear functions and joint test of
nonlinear restrictions.
Wald Statistic          =      198.87913
Prob. from Chi-squared[15] =      .00000
Functions are computed at means of variables
-----+-----
--
      |                               Standard   Prob.      95% Confidence
WaldFcns| Coefficient      Error      z      |z|>Z*      Interval
-----+-----
--
Fncn(1)| -11.7064***      1.32703   -8.82   .0000      -14.3073   -9.1055
Fncn(2)| -14.2708***      1.69622   -8.41   .0000      -17.5953  -10.9463
Fncn(3)| -15.4953***      1.94862   -7.95   .0000      -19.3145  -11.6761
Fncn(4)| -11.1794***      1.23830   -9.03   .0000      -13.6064   -8.7524
Fncn(5)| -12.3314***      1.44532   -8.53   .0000      -15.1641   -9.4986
Fncn(6)| -1352.38          14308.65   -.09    .9247      -29396.81  26692.05
Fncn(7)|  28.8322          405.8370   .07     .9434      -766.5936  824.2581
Fncn(8)|  85.2371          991.1671   .09     .9315      -1857.4146 2027.8889
Fncn(9)|  375.623          4095.051   .09     .9269      -7650.530  8401.776
Fncn(10)| -59.3429          544.6859   -.11    .9132      -1126.9076 1008.2218
Fncn(11)| -23.6999***      4.24072   -5.59   .0000      -32.0116  -15.3882
Fncn(12)| -2.95204          2.01474   -1.47   .1429      -6.90087   .99678
Fncn(13)|  4.50341          3.47878   1.29    .1955      -2.31487   11.32170
Fncn(14)|  14.5235**        5.78113   2.51    .0120      3.1927     25.8543
Fncn(15)|  7.49996*         4.14065   1.81    .0701      -.61557    15.61549
-----+-----
--
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
-----
--

```

10.2.7 Positive in class 1 and 2, 3 class lcm plus wtp including statistically significant socio econ groups LIVESWEN, GENMR, PROF, JOBEMP – code and output

```

|-> NLOGIT;
Lhs      =          choice,      cset,      alti;
Choices  =          a,          b,          c,          d;
Model:
U(a)=  csta*ATTB_A          +          cstb*ATTB_B          +
      cstc*ATTB_C          +          cstd*ATTB_D          +
      cste*ATTB_E          +          cstf*cost/
U(b)=  csta*ATTB_A          +          cstb*ATTB_B          +
      cstc*ATTB_C          +          cstd*ATTB_D          +
      cste*ATTB_E          +          cstf*cost/
U(c)=  csta*ATTB_A          +          cstb*ATTB_B          +
      cstc*ATTB_C          +          cstd*ATTB_D          +
      cste*ATTB_E          +          cstf*cost/
U(d)=  ascd;
LCM= LIVESWEN, GENMR, PROF, JOBEMP;
parameters;
pts=3;
Pds      =          8$;
Normal exit:  5 iterations. Status=0, F=          6169.598
-----
--

```

Discrete choice (multinomial logit) model

Dependent variable Choice  
 Log likelihood function -6169.59788  
 Estimation based on N = 5168, K = 7  
 Inf.Cr.AIC = 12353.2 AIC/N = 2.390  
 Model estimated: Oct 05, 2020, 13:43:33  
 R2=1-LogL/LogL\* Log-L fncn R-sqrd R2Adj  
 Constants only must be computed directly  
 Use NLOGIT ;...;RHS=ONE\$  
 Response data are given as ind. choices  
 Number of obs.= 5168, skipped 0 obs

```
-----+-----
```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
CSTA 1	1.50800***	.08136	18.53	.0000	1.34853	1.66747
CSTB 1	.41312***	.08194	5.04	.0000	.25252	.57371
CSTC 1	.27535***	.07945	3.47	.0005	.11963	.43107
CSTD 1	-.12704	.08524	-1.49	.1361	-.29410	.04002
CSTE 1	.25096***	.08053	3.12	.0018	.09312	.40881
CSTF 1	-.03814***	.00830	-4.59	.0000	-.05442	-.02187
ASCD 1	.36529***	.12958	2.82	.0048	.11132	.61925

```
-----+-----
```

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

Normal exit: 61 iterations. Status=0, F= 5326.795

```
-----+-----
```

Latent Class Logit Model  
 Dependent variable CHOICE  
 Log likelihood function -5326.79456  
 Restricted log likelihood -7164.36926  
 Chi squared [ 31 d.f.] 3675.14939  
 Significance level .00000  
 McFadden Pseudo R-squared .2564880  
 Estimation based on N = 5168, K = 31  
 Inf.Cr.AIC = 10715.6 AIC/N = 2.073  
 Model estimated: Oct 05, 2020, 13:43:40  
 Constants only must be computed directly  
 Use NLOGIT ;...;RHS=ONE\$  
 At start values -6169.6289 .1366\*\*\*\*\*  
 Response data are given as ind. choices  
 Number of latent classes = 3  
 Average Class Probabilities  
 .307 .413 .280  
 LCM model with panel has 646 groups  
 Fixed number of obsrvs./group= 8  
 Number of obs.= 5168, skipped 0 obs

```
-----+-----
```

CHOICE	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Utility parameters in latent class -->> 1						
CSTA 1	.78786***	.15986	4.93	.0000	.47453	1.10119

```

CSTB|1|      .96266***      .16290      5.91      .0000      .64339      1.28192
CSTC|1|      1.04789***      .16534      6.34      .0000      .72383      1.37194
CSTD|1|      .75772***      .17365      4.36      .0000      .41737      1.09806
CSTE|1|      .83472***      .15740      5.30      .0000      .52623      1.14321
CSTF|1|     -.06763***      .01670      -4.05     .0001     -.10035     -.03491
ASCD|1|     -1.05991***      .31779      -3.34     .0009     -1.68277     -.43705
|Utility parameters in latent class --> 2
CSTA|2|      2.56575***      .21016     12.21     .0000      2.15384      2.97766
CSTB|2|     -.05513      .20455      -.27      .7875     -.45604      .34577
CSTC|2|     -.17171      .17959      -.96      .3390     -.52370      .18028
CSTD|2|     -.72665***      .20391     -3.56     .0004     -1.12631     -.32699
CSTE|2|      .09879      .19007      .52      .6032     -.27373      .47131
CSTF|2|     -.00061      .02016      -.03      .9757     -.04012      .03889
ASCD|2|     -.66379*      .34430     -1.93     .0539     -1.33861      .01102
|Utility parameters in latent class --> 3
CSTA|3|      1.81111***      .19187      9.44      .0000      1.43505      2.18718
CSTB|3|      .22307      .18736      1.19     .2338     -.14416      .59029
CSTC|3|     -.33065*      .19346     -1.71     .0874     -.70983      .04852
CSTD|3|     -1.08402***      .20252     -5.35     .0000     -1.48094     -.68710
CSTE|3|     -.55311***      .19390     -2.85     .0043     -.93314     -.17308
CSTF|3|     -.07644***      .01806     -4.23     .0000     -.11184     -.04104
ASCD|3|      .84367***      .30259      2.79     .0053      .25060      1.43673
|This is THETA(01) in class probability model.
Constant|    -.78654***      .19511     -4.03     .0001     -1.16895     -.40413
LIVES|1|      .62285      .44886      1.39     .1653     -.25690      1.50260
GENMR|1|      .65215**      .27873      2.34     .0193      .10585      1.19846
_PROF|1|      1.03728***      .25714      4.03     .0001      .53329      1.54127
JOBEM|1|      .55145**      .24263      2.27     .0230      .07591      1.02699
|This is THETA(02) in class probability model.
Constant|    -.18910      .17402     -1.09     .2772     -.53017      .15198
LIVES|2|      .75768*      .42636      1.78     .0756     -.07798      1.59333
GENMR|2|      .22254      .27131      .82     .4121     -.30921      .75429
_PROF|2|      .29370      .24859      1.18     .2374     -.19354      .78093
JOBEM|2|      .82886***      .23078      3.59     .0003      .37654      1.28117
|This is THETA(03) in class probability model.
Constant|      0.0      .....(Fixed Parameter).....
_LIVES|3|      0.0      .....(Fixed Parameter).....
_GENMR|3|      0.0      .....(Fixed Parameter).....
_PROF|3|      0.0      .....(Fixed Parameter).....
_JOBEM|3|      0.0      .....(Fixed Parameter).....

```

```

-----
--
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
Fixed parameter ... is constrained to equal the value or
had a nonpositive st.error because of an earlier problem.
-----
--

```

```

|->
|-> Wald;
    Pts=1000;
    Labels =
    b1,    b2,    b3,    b4,    b5,    b6,    a1,
    c1,    c2,    c3,    c4,    c5,    c6,    a2,
    d1,    d2,    d3,    d4,    d5,    d6,    a3,
    e1,e2,e3,e4,e5,e6,e7,e8,e9,e10,e11,e12,e13,e14,e15;
    Start =      b;
    Var    =      varb;
    Fn1    =      b1/b6;
    Fn2    =      b2/b6;
    Fn3    =      b3/b6;

```

```

Fn4    =      b4/b6;
Fn5    =      b5/b6;
Fn6    =      c1/c6;
Fn7    =      c2/c6;
Fn8    =      c3/c6;
Fn9    =      c4/c6;
Fn10   =      c5/c6;
Fn11   =      d1/d6;
Fn12   =      d2/d6;
Fn13   =      d3/d6;
Fn14   =      d4/d6;
Fn15   =      d5/d6$;

```

```

-----
--
WALD procedure. Estimates and standard errors
for nonlinear functions and joint test of
nonlinear restrictions.

```

```

Wald Statistic      =      201.86092
Prob. from Chi-squared[15] =      .00000
Functions are computed at means of variables
-----

```

```

-----
--

```

WaldFcns	Coefficient	Standard Error	z	Prob.  z >Z*	95% Confidence Interval	
Fncn (1)	-11.6491***	1.31667	-8.85	.0000	-14.2298	-9.0685
Fncn (2)	-14.2337***	1.68162	-8.46	.0000	-17.5296	-10.9377
Fncn (3)	-15.4939***	1.93974	-7.99	.0000	-19.2957	-11.6921
Fncn (4)	-11.2035***	1.23867	-9.04	.0000	-13.6312	-8.7757
Fncn (5)	-12.3420***	1.44298	-8.55	.0000	-15.1702	-9.5138
Fncn (6)	-4174.57	136629.4	-.03	.9756	-271963.33	263614.19
Fncn (7)	89.7050	3243.309	.03	.9779	-6267.0648	6446.4747
Fncn (8)	279.378	9419.953	.03	.9763	-18183.391	18742.147
Fncn (9)	1182.29	39071.18	.03	.9759	-75395.82	77760.39
Fncn (10)	-160.731	4996.920	-.03	.9743	-9954.515	9633.052
Fncn (11)	-23.6924***	4.17465	-5.68	.0000	-31.8746	-15.5102
Fncn (12)	-2.91811	1.96997	-1.48	.1385	-6.77918	.94297
Fncn (13)	4.32550	3.37108	1.28	.1995	-2.28170	10.93270
Fncn (14)	14.1808**	5.59584	2.53	.0113	3.2132	25.1485
Fncn (15)	7.23562*	4.01911	1.80	.0718	-.64169	15.11292

```

-----
--

```

```

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.
-----
--

```

**Summary table for Coefficient and Standard error for statistically significant socioeconomic parameters that describe classes in the 3 class LCM**

Socioeconomic parameter	Class 1		Class 2		Class 3	
	Coeff	Standard error	Coeff	Standard error	Coeff	Standard error
GENMR	0.65**	0.28	0.22	0.27	0.0	0.0

PROF	1.04***	0.26	0.29	0.25	0.0	0.0
JOBEMP	0.55**	0.24	0.83***	0.23	0.0	0.0
LIVESWEN	0.62	0.45	0.76*	0.43	0.0	0.0
Average Class Probability	0.307	30.7%	0.413	41.3%	0.280	28%

Note: Statistically significant at: \*1%, \*\*5% and \*\*\*10% level of significance

Summary table for WTP in sterling pounds for all attributes in the 3 class LCM when analysed alongside statistically significant socioeconomic parameters

Class	Attribute	WTP with Socio economic analysis	Lower (95% CI)	Higher (95% CI)
1	HARDY	£11.65***	-14.23	-9.07
	NAMED CULTIVAR	£14.23***	-17.53	-10.94
	RARE IN CULTIVATION	£15.49***	-19.29	-11.69
	RARE IN WILD	£11.20***	-13.63	-8.78
	KWP	£12.34***	-15.17	-9.51
2	HARDY	£12.34	-271963.33	263614.19
	NAMED CULTIVAR	-£89.71	-6267.06	6446.47
	RARE IN CULTIVATION	-£279.38	-18183.39	18742.15
	RARE IN WILD	-£1182.29	-75395.82	77760.39
	KWP	£160.73	-9954.52	9633.05
3	HARDY	£23.69***	-31.87	-15.51
	NAMED CULTIVAR	£2.92	-6.78	0.94
	RARE IN CULTIVATION	-£4.33	-2.28	10.93
	RARE IN WILD	-£14.18**	3.21	25.15
	KWP	-£7.24*	-0.64	15.11

Note: Statistically significant at: \*1%, \*\*5% and \*\*\*10% level of significance

### 10.3 END